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MUSEUM,

Register, Journal,

AND

GAZETTE,

JULY 7TH — DECEMBER 29TH, 1849.

EDITED BY J. C. ROBERTSON.

VOL. LI.

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Edited by J. C. Robertson, 166, Fleet-street.

COOK'S ELECTRO-MAGNETIC ORE SEPARATOR.

Fig. 1.

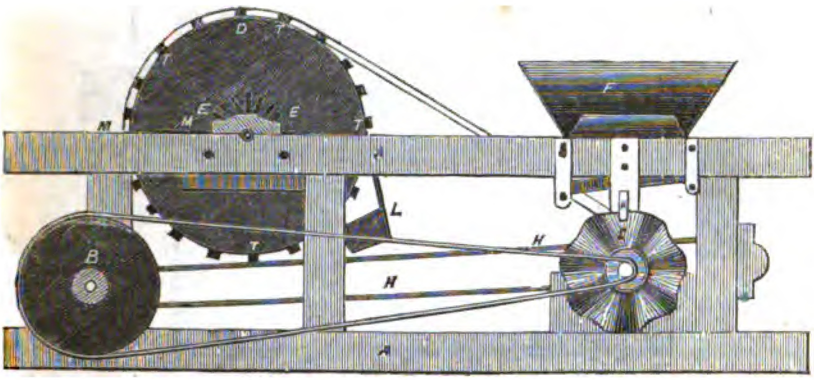
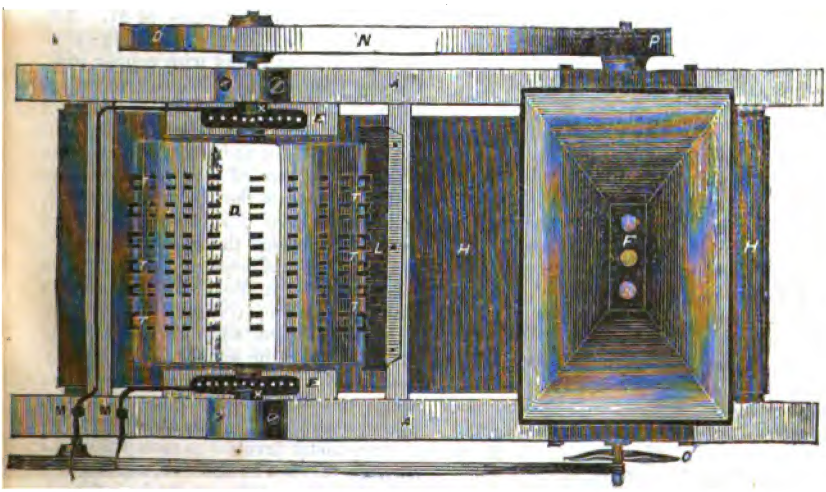
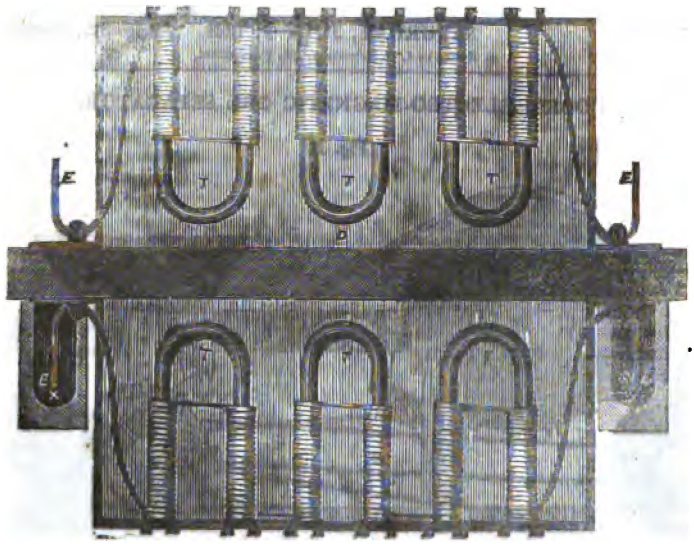


Fig. 2.



COOK'S ELECTRO-MAGNETIC ORE SEPARATOR.

Fig. 3.



The machine represented in the accompanying engravings was invented by Ransom Cook, Esq., late Superintendent of the Clinton County State Prison, in the State of New York, and employed for the separation of the magnetic ore at the mines in that place. Our description of it is derived from the *Scientific American*. The principle of this invention consists in charging successively, by a battery, different rows of magnets on a revolving cylinder, so that the magnets shall lift magnetic ore from an endless web as it passes under the cylinder; and so also that when the ore is lifted up a short distance the electric connection shall be broken with the magnets, and the ore then drop from them into a trough, and be discharged into a proper receptacle.

Fig. 1, is a side elevation of the machine; fig. 2, a top plan; and fig. 3, a sectional view.

AA is the frame; B is a pulley, by which the cam-shaft, C, is revolved. This shaft by the cam, C, shakes the hopper, F, so as to spread the ore evenly across the web, H. This is done by having a hook rod that catches the upper edge of C, and is made, from the shape of the cam, to traverse across the web, and spread the ore equally on the web. D is the revolving magnet cylinder, driven by band and pulleys, O, N. P. L is the trough into which the ore is discharged from the cylinder. X X are mercury troughs, the one charged positively, and the other negatively, from the battery, by the wires M M. The magnets are fixed on the revolving cylinder, and wound round with copper wire, the one positive and the other negative. These wires are carried from one magnet to another across the row, and brought out at the axle of the cylinder, to form a circular fan row of the points of the wires, so that as the cylinder revolves, and these wires dip into the charged mercury troughs, the rows of magnets are charged and broken alternately, to lift the ore from the dross, and deposit it in the receiving trough.

K is the hook shaft or bar which is made to shake the hopper, F, as already described. H is the endless web or apron carrying the ore forward to the magnets on the cylinder, D. The magnetic cylinder revolves to meet the ore as it comes forward on the web, and not in a contrary direction, as might be inferred. TT are the magnets. M represents the

wires from the battery. The large cylinder is revolved by a broad band from the other side passing over a large pulley on the shaft of D, the magnetic cylinder. E represents the copper wires that are wound around the magnets, showing the manner in which they are formed on the outside of the axle, so as to dip into the charged mercury troughs and be charged. As they rise out of the troughs, the electric current is broken and the magnets discharged. As the cylinder is made of wood, it is non-conducting, and to keep the wires from the axle of the cylinder, it (the axle) is boxed up with wood and wires turned up on the outside of it.

Fig. 3 shows the manner in which the magnets are arranged on the cylinder. D, is the cylinder; T T, the magnets; E, the current wires; and X, the trough or vessel of quicksilver. The cylinder is about 30 inches in diameter, and the magnets are about five-eighths of an inch thick with four polar points, the negative and the positive on each magnet. There is a space of about three-fourths of an inch between each of the magnets, and a large one has had ten magnets in a row with thirty rows on the cylinder. It will be observed that the wires are alternately wound in the direction of the polar currents. One wire is now represented as dipping in the mercury, but one-fourth of all the magnets are charged at the same time, as that number touch the mercury on the under side of the cylinder; but the magnets are charged and discharged successively in rows. The ore is carried forward on the endless apron; and the magnet cylinder, by revolving in the same direction as the apron, lifts the ore, while the dross is discharged from the apron while passing over the roller.

This machine is not an untried one. It has been fairly tested, having been in operation at Plattsburg for some time, where it is stated to have exceeded the most sanguine expectations. When ore is associated with hornblende, no other process of separation can it appears compare with this.

ON FLAMBING THE BOWS OF SHIPS.—IN ANSWER TO "F." ("MECH. MAG.," NO. 1349.)

Mr. Editor,—Almost in every sailing vessel, and certainly in all vessels carrying goods, the weight of displacement at some distance from the stem is less than the weight of hull and lading, &c., included in the same part of the ship. This deficiency of buoyancy at the extremities cannot be obviated, except by adopting an entirely different plan of construction in our men-of-war; but we should not increase the evils attendant on the same, when as yet no better plan of carrying the armament in the bows has been practically carried out.

This want of displacement for those necessary weights which, in every class of men-of-war are fixed to an almost unalterable distance from the stem, "F." has not, apparently, taken into account, as appears from his conclusions. "F." begins his conclusions as follows:

"*Because the displacement or weight of the section of* A *before* a *is very much greater than the similar one before* b *in* B, *its momentum will be greater.*"

Now, the displacement of A before *a* cannot very properly be substituted for the weight of the section before *a*, these two quantities being, as said above, never equal.

"F's" next remark is—

"*Because the displacement of* A *before* a *is greater than that before* b *in* B, *so* A *will lose more buoyancy by the passage of the wave aft than* B, *and* a *will require to fall further than* B *before the equalisation of weight and buoyancy is restored.*"

The displacement of A will certainly lose more buoyancy than B by the passage of the wave behind; but it can also afford to lose more than B, being less deficient in buoyancy for the weights it has to carry than the form B; and although the bow A will rise higher on the crest of the wave, it will never fall so deep in the hollow of the wave as that of B. First, at the moment when the weights in the bow plunging in the hollow of the passing wave are supported by an equal weight of water, the falling ceases, and this moment must arrive earlier in A than in B; the water will embrace the bow, B, an inch nearer to the deck than the full bow, A, which possesses a greater fullness at and above the water line.

It may be well to state that I am neither an advocate for an overhanging bow, nor for an excessive full forebody

under water; the one, brought to excess, must always be injurious to the strength of the fabric; the other diminishes the speed; but where an overhang is rendered necessary by other unavoidable circumstances, I cannot agree with "F" where he says, "*the form, therefore, could only lessen the evil its greater weight had first increased,*" for the greater weight of hull at that part bears but a small ratio to the gain of displacement when in the act of falling.

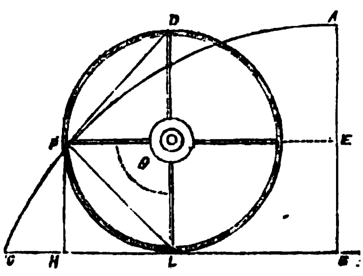
I certainly agree with your able correspondent in most of his views; but as long as a determinate quantity of weights are to be carried at a certain distance from the perpendicular in the load water line, the most dangerous form for the structure must be that which takes away the already deficient buoyancy for those weights. I am, Sir, yours, &c.,

B. I.

REMARKS UPON THE MOTION OF ROLLING WHEELS.

Sir,—At page 512 of the *Mechanics' Magazine*, vol. l., a paragraph is inserted from the proceedings of the "Institution of Mechanical Engineers," which appears to me invested with more than an ordinary share of interest on account of the many important mechanical principles it involves. The paragraph to which I allude has reference to the comparative effects of wheels revolving upon their axles, and at the same time rolling upon a plane as in the practical case of the wheels of railway carriages; and as the approximate results were only abstractly stated, I was led at the time they appeared to make a few remarks upon the points involved, which I herewith subjoin, and which I regret my time has not permitted me to mature and extend.

Fig. 1.



Referring to the preceding figure (1), let C be the origin of rectangular axes; P, the generating point on the circumference of the wheel (being also the extremity of a spoke,) $CH = x$, $HP = y$, θ the arc to radius unity described uniformly by P around the axis of the wheel, and a the radius of the wheel.

Then from the properties of the cycloid we have

$$\left.\begin{array}{l} x = a\theta - a\,.\sin\theta \\ y = a - a\,.\cos\theta \end{array}\right\} \ldots\ldots\ldots (1.)$$

But from another property of the cycloid, any arc AP of that curve measured from the vertex A is $= 2\sqrt{AB \times AE}$; representing this arc by s, and the abscissa AE by Z, we have therefore,

$$s = 2\sqrt{2az} \ldots\ldots\ldots\ldots\ldots (2.)$$

By inspection of the figure it will be seen that $AE = 2a - y = 2a - (a - a\cos\theta)$ from *eq.* (1); $\therefore z = a + a\cos\theta$.—Substituting this value of z in (2) we obtain

$$s = 2a\sqrt{2\,.(1 + \cos\theta)} \ldots\ldots (3.)$$

It appears from this last equation, that when the point P coincides with C, $s =$ the semi-cycloid, and $\cos\theta = 1$; $\therefore$ in that event equation (3) becomes

$$s = 4a.$$

When the spoke PO attains the horizontal position (as in the figure), $\cos\theta = 0$, and equation (3) becomes

$$s = 2a\sqrt{2}.$$

When the point P arrives at A, the spoke PO coincides with AB, and $\cos\theta = -1$; hence at this point equation (3) vanishes with the cycloidal arc s.

Differentiating equation (2) we have

$$\frac{az}{as} = \frac{s}{4a}.$$

The first member of this equation is the cosine of the angle which the tangent to the curve at any point P makes with the axis AB.—Draw therefore DL parallel to AB, and join PL, PD; then is PD a tangent, and PL a normal to the curve at the point P; hence the generating point P, at every instant of its motion revolves about the point of contact L, with a velocity varying directly as the length of the normal PL; and the velocity of translation of the axis being given, that of the point P in the cycloidal arc is directly as PL.

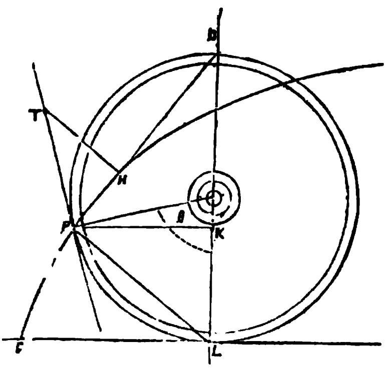
Because the angle at the centre of a circle is double that at the circumference,

$\therefore \angle$ PDL = half POL $= \frac{\theta}{2}$. Hence the normal at any point P is

$$PL = 2a . \sqrt{\frac{1-\cos\theta}{2}} \ldots\ldots\ldots (4.)$$

The motion of P is compounded of two others, that of rotation around the axis of the wheel, and that of translation in the direction PE.—To estimate the velocity of P in the cycloidal arc, draw the tangent PT (fig. 2) to the circum-

Fig. 2.



ference at P, and HT perpendicular to PD, and let V = the velocity of translation. The $\angle$ PTH $= \angle$ PDK $= \frac{\theta}{2}$ and the angular velocity of a point in the spoke at an unit of distance from the centre is $\frac{V}{1} = V$.—The velocity of rotation resolved in the direction of the cycloid is therefore,

$$V . \sin\frac{\theta}{2} = V . \sqrt{\frac{1-\cos\theta}{2}} \ldots\ldots (5.)$$

But this velocity takes place around the point of contact L, at the distance LP; representing, therefore, the velocity of P in its cycloidal path by A, multiplying together equations (4) and (5), and reducing, we obtain

$$A = V . a . (1-\cos\theta) \ldots\ldots (6.)$$

Comparing this equation with the figure, it will be seen that when the spoke touches the rail at C, the cos $\theta = 1$, and the expression vanishes, indicating a point of rest.

When the spoke becomes horizontal, cos $\theta = 0$, and the velocity in the cycloid is then equal that of rotation about the axis of the wheel $= a\,v$.—

When P arrives at A, cos $\theta = -1$; the velocity at this point is therefore *double* that of rotation, or $2a\,v$.—

For the mean velocity (V_1) of P in its path—that is, the velocity, which if continued uniform, the point P would describe the semi-cycloid in the same time—we have

$$\pi : 4 :: V : V_1$$

$$\therefore V_1 = V . \frac{4}{\pi} = 1{\cdot}2732V \ldots\ldots (7.)$$

To determine the position of the spoke at which its extremity P attains this mean velocity; equating the second members of (6) and (7) and solving for cos θ, to rad. unity, we find,

$$\cos\theta = 1 - \frac{4}{\pi} \ldots\ldots\ldots\ldots (8.)$$

Making the calculation indicated in this last equation, and observing that the effect must take place in the second quadrant where cos θ is negative, it will be found that the position sought is 15°. 51′ above the horizontal line, or 105°. 51′ from the point of contact with the rail.

The paragraph (page 512, vol. l., col. 1) before alluded to refers to most of these results, with many others of great interest and much importance, and which would amply repay the trouble of investigation if time permitted.

Believe me truly yours,

T. Smith.

Bridgetown, Wexford, June 28, 1849.

ROTARY ENGINES.

(From the *Times*.)

The following account of an improved disc engine, lately fitted up and used in driving the *Times* printing machines, appears in the *Builder*. The engine gives direct motion to a crank upon which the shaft of the disc exerts a uniform force. It is of simple construction, and, amongst other advantages, is capable of being worked at high or low pressure, and at from 80 to 150 revolutions per minute:—

"Bishopp's Disc Engine.—In this engine, the advantages of which have been long known, the objections that alone kept it out of general use appear to have been successfully overcome. It is a 16-horse

power engine, on the high-pressure and condensing principle; it is, however, equally suitable to be worked as a simple low-pressure condensing engine. It stands in the machine-room close to a wall, and occupies a singularly small space.* The shafting for driving the printing machines is carried by brackets fixed to the wall over the engine, and is driven by two bands; the drum on the engine-shaft is 30 inches diameter, and the two pulleys overhead 4 feet diameter.

"Our impressions in favour of the engine were confirmed by inquiry. It seems that before being erected at the *Times* office, it was tested, during a month, by Mr. Penn, of Greenwich, and Mr. Farey (both good authorities), in a corn-mill belonging to the former. The comparison was made with a beam engine of the best construction, and, under similar circumstances, there was an important difference in favour of the disc engine, the engines driving alternately the same machinery, at equal speed, from the same boiler. Several disc engines have been fixed in various parts of the kingdom during the last eight years, but the arrangements lately patented by Mr. G. D. Bishopp have so much improved it as to open to it a much larger sphere of action. This at the *Times* office was manufactured by Messrs. Joseph Whitworth and Co., of Manchester. The peculiarity of the disc engine is, that it gives *direct motion* to a crank on the engine shaft, and exerts a perfectly uniform force on it throughout the revolution. There are, therefore, no "dead points;" and when driving by gearing, without a fly-wheel, there is no back-lash in the wheels. Moreover, the steam can be cut off at a very early part of the stroke, without materially affecting the regularity of the driving force. Other advantages besides the little space occupied are, that it can be fixed on the beams of a floor, or on a slight foundation, and that, although the speed of the piston (*i. e.*, of the disc rings) is only 200 feet per minute, the engine makes three times as many revolutions per minute as a common engine, and, consequently, in most cases, much expensive gearing is dispensed with. It appears to us admirably adapted for driving the screw propeller direct, as the engine shaft has only to be extended through the vessel, and have the propeller fixed to it; it would thus enable sailing vessels which cannot spare much room to adopt the screw as auxiliary power. The disc engines are now made entirely from wooden patterns, and every wearing surface, it is said, can be refaced or renewed, as in engines of the common construction. We cannot but think that this engine ought to come into general use."

The rotary engine referred to in the preceding article, and called "Bishopp's Disc Engine," is the old disc engine of Davies and Taylor revived, which some eight or ten years ago caused some stir in Birmingham, but proved in the hands of a Company which was formed for working the invention an utter failure. Mr. A. Bishopp has lately invented and patented some improvements in the engine, which are supposed to have given quite a new face to the affair; and hence the new name, under which it now presents itself once more as a candidate for public favour.

[It may be here proper, in order to prevent mistakes, to state that the Mr. Davies of the "Disc" engine is a totally different person from Mr. Davies, the inventor of the rotary engine, which has recently occupied so prominent a place in our pages; and that the inventions are also very different. The former is a Mr. Henry Davies, of Stoke Prior, Worcestershire—the latter Mr. Isaiah Davies, of Birmingham.]

Whether Mr. Bishopp's improvements are likely to obviate the objections which existed to the disc engine in its original state, we are unable to say, not having as yet had an opportunity of seeing it in its improved form; but we shall, at all events, require some better evidence than a mere trial of "a month"—even though conducted under the superintendence of such eminently competent judges as Mr. Penn and Mr. Farey—before we put much faith in its capabilities. Let it work for sixteen months uninterruptedly, as Mr. Isaiah Davies's rotary engine has done at Messrs. Edelstein and Williams's, Birmingham (see last vol., p. 124)—without any perceptible change, and with entire satisfaction to those using it, and then we shall say that Mr. Bishopp has indeed achieved something as extraordinary as unexpected.

On the authority quoted by the *Times* we place, for obvious reasons, no reliance. The language and reasoning used are evi-

* Seven feet long, and four feet wide; and the highest part of the engine is only three feet above the floor of the room.

dently such as could proceed from no *professional* pen; *e. g.*, the writer talks of direct action being a "peculiarity of the disc engine;" having evidently not the least notion of its being a peculiarity which it shares with all the rotary engines ever constructed.

We gather from the specification of Mr. Bishopp that his improvements have mainly for their object the better packing of the moving parts. No doubt these are improvements in the right direction, but they do not, we apprehend, meet all the difficulties of the case.

Be the merits, however, of this "modern antique" what they may, it is to us a source of great gratification to find that we have now with us such high authorities as Mr. Penn, Mr. Farey, Messrs. Whitworth and Co., of Manchester, and (though last, not least,) the proprietors of the *Times* newspaper, in thinking that the rotary principle of action is by no means that illusory conceit which it has been commonly pronounced to be; but, on the contrary, a rationality deserving of all possible favour and encouragement. Mr. Bishopp is lucky in having been honoured with such high patronage, and will richly merit every personal advantage which complete success may bring him. Come what may, too, the friends and advocates of the rotary system must own themselves deeply indebted to Mr. Bishopp, for obtaining for their common principle of action a degree of public attention, which they might otherwise have long looked for in vain.

ON THE SPECIFIC HEAT OF CERTAIN ALLOYS, AND THEIR SPONTANEOUS INCREASE OF TEMPERATURE AFTER SOLIDIFICATION. BY M. C. C. PERSON.

M. Regnault has discovered, in alloys fusible at about 212° Fahr., a specific heat much greater than the mean of the metals composing them, and proposes to examine whether this anomaly does not disappear at lower temperatures. The experiments reported in my memoir show that it does, in effect, disappear. Thus, in the alloy of d'Arcet,* I have $c=0{\cdot}096$ from 201·2°, and $c=0{\cdot}037$ from 122°; as the calculated mean is 0·036, it will be perceived that the difference is very trifling.

I make it appear that the excess of heat observed in this alloy, near its melting point, is not owing to the commencement of fusion, as might be imagined, but to a new kind of latent heat, of which the following experiment shows the evolution:—A glass bulb, filled with the alloy in question, is isolated in such manner that the cooling may be observed; and for that purpose there is fixed in the alloy a thermometer, of which the changes may be noted with an eye-glass and stop-watch. Suppose the glass vessel to contain 150 grammes of the alloy of d'Arcet, the thermometer, which, at about 266°, takes five or six seconds to fall two degrees when the alloy is in a liquid state, takes more than 400 seconds to fall 3·6° between 204·8° and 201·2°. This is very simple: the latent heat of fusion is very disengaged during this interval. The solidification being completed, the thermometer resumes a regular rate, falling one degree in five or six seconds, until about 134·6° where it suddenly stops, and even rises two or three degrees. At the same time, the glass bulb is broken by a considerable expansion of the whole mass, and this expansion continues after the cooling, so that the thermometer, which was before strongly pressed, becomes free and movable. There is, therefore, in this, a change of constitution in the alloy, and the heat which was disengaged during this modification was sufficient to sustain the thermometer between 130·4° and 132·8° for more than 400 seconds; but it then immediately fell one degree in five or six seconds. The disengagement of heat afterwards continues for a long time, of which we have proof by the extraordinary slowness of the cooling.

If, after having melted the alloy, it be suddenly cooled by plunging it into water, and then withdrawn as soon as it may be safely handled, it will, in a few moments, become again so warm as to burn the fingers. Here, the sudden cooling is at first opposed to the change of constitution; but a moment arrives at which the disposition of the molecules ceases to be compatible with so slow a temperature, and then the new arrangement takes place. And, on account of having been thus retarded, it recurs with much more energy, that is, in a much shorter

* This alloy is composed of bismuth, 8; lead, 5; and tin, 3. It is known as "Babbet's Fusible Metal," and melts at a temperature below that of boiling water.

time; it is not only a slower cooling which is observed, but a reheating which may carry the mass to 158°

To recapitulate: the excess of caloric given out by alloys, when heated nearly to their melting point, does not proceed from the latent heat of fusion; nor should it be considered as being simply specific heat—it is heat due in a great measure to change of constitution, which may take place in an alloy completely solidified and considerably below its melting point.—*Comptes Rendus*, *Sept.* 27, 1847.

MESSRS. BROOKE AND SON'S IMPROVED WATER-TIGHT NIPPLE AND PERCUSSION CAP.

[Registered under the Act for the Protection of Articles of Utility. Edward Brooke and Son, of Russell-street, Birmingham, Proprietors.]

Fig. 1.

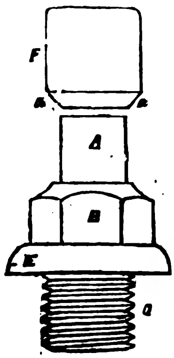


Fig. 2.

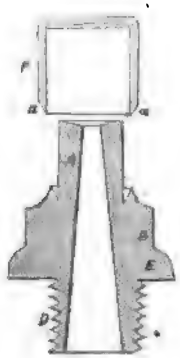


Fig. 4.

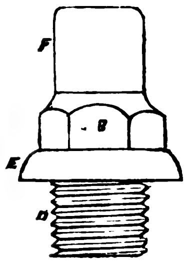


Fig. 5.

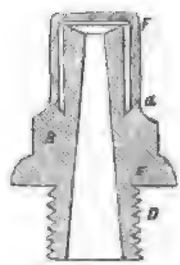


Fig. 3.

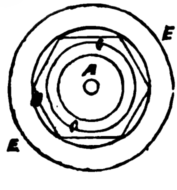


Fig 6.

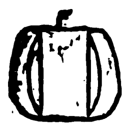


Fig. 7.

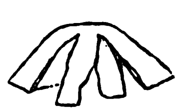


Fig. 1 of the above engravings is an external elevation of this improved nipple and cap; fig. 2, a sectional elevation, and fig. 3, a plan of the nipple alone. A, the pillar of the nipple is made in one piece with the "squares" B B; C is a circular bevelled cutting formed in the upper part of the cap on B, and immediately surrounding the base of the pillar A; D is a screw, by which the nipple is attached to the breech of the barrel, having a flange, E, at its upper part, which rests upon the breech; F is the cap, the peculiarity of which consists in the lower part, *a*, being bevelled in a manner corresponding to the cutting, C, formed in the "squares."

The object of this improvement is, that when the cap is placed upon the pillar, A, as represented in figs. 4 and 5, the bevelled part, *a*, of the cap, shall, when pressure is applied to it, be forced into the bevelled cutting, *c*, and form a perfectly water-tight joint.

Another advantage is, that when the cap is fired, the cutting prevents the spread of the cap, and thus obviates all danger arising from splinters, and also renders the discharge of the firearm certain, as the whole of the fire of the cap is discharged into the nipple, and not as in ordinary cases, little more than a fourth.

Fig. 6, is a view of this improved cap after it has been used.

Fig. 7, a view of one of the ordinary caps under the same circumstances.

MESSRS. ASHFORD'S IMPROVED HOLDER FOR WHIPS, STICKS, AND OTHER SIMILAR ARTICLES.

[Registered under the Act for the Protection of Articles of Utility. William and George Ashford, of Birmingham, Whip-makers, Proprietors.]

Fig. 1.

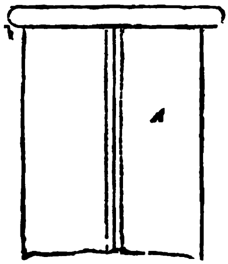


Fig. 3.

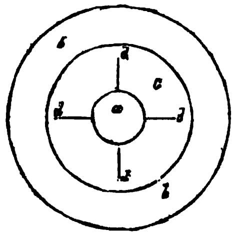


Fig. 2.

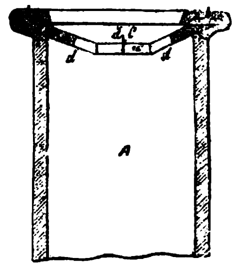


Figure 1 is an external elevation; fig. 2 a section; and fig. 3, a top plan of this improved holder. A A is the body, which is made hollow, and is closed at bottom, but is left open at top, where it terminates in a ring, *b*, of ivory, silver, or any other kind of metal, covered, or not covered with leather, gutta percha, or other suitable material. C is a piece of vulcanized India rubber, or other suitable material, which is stretched across the opening in the top of the holder, in the manner shown in figs. 2 and 3, but has an orifice, *a*, cut in the centre to allow of the stick of the whip, &c., being passed through, and into the body of the holder when required. There are also small cuts, or slits, *d d*, made in this piece to facilitate the entrance and withdrawal of the whip, &c., and also to admit of its adapting itself more securely to the form of the article required to be held. The orifice, *a*, is made of much smaller diameter than the stick or whip, in order that it may exert a kind of spring, and so hold the article firm in its place, and prevent the wear and tear so incidental to the ordinary kind of holders.

STRENGTH OF GUTTA PERCHA TUBING.

A series of interesting experiments have just been concluded at the Birmingham Waterworks, relative to the strength of Gutta Percha Tubing, with a view to its applicability for the conveyance of water. The experiments were made (under the direction of Henry Rofe, Esq., Engineer), upon tubes three-quarters of an inch diameter and one-eighth of gutta percha. These were attached to the iron main, and subjected for two months to a pressure of 200 *feet head of water*, without being in the slightest degree deteriorated. In order to ascertain if possible the maximum strength of the tubes, they were connected with the Water Company's hydraulic proving pump, the regular load of which is 250 *lbs.* on the square inch. At this point the tubes were unaffected, and the pump was worked up 337 *lbs.*, but to the astonishment of every one the tubes still remained perfect. It was then proposed to work the pump up to 500 lbs., but it was found that the lever of the valve would bear no more weight. The utmost power of the hydraulic pump could not burst the tubes.

The gutta percha being somewhat elastic, allowed the tubes to become slightly expanded by the extraordinary pressure which was applied, but on its withdrawal they resumed their former size.

THE BRITISH MUSEUM.*

Whether the "suggestions" here thrown out will ever be acted upon, even in a modified form, is exceedingly problematical; but it is almost certain that the "Observations" will excite some stir, and no doubt will in time win their way to permanent reputation. The subject which Mr. Fergusson has now taken up is an important, because a national one, and the ability with which he treats it is such as to command attention. Hitherto the British Museum has been generally regarded with a sulky silence, as cold and as chilling as the architecture of the edifice itself; for in no one instance—as far as we are aware—has it received aught of cordial approbation. Where criticism has been brought to bear openly upon it, "blame," as Mr. Fergusson says, "has been loud and deep. That a structure on which just about 700,000*l.* of the public money has been expended, should be an utter failure as a work of art,—that it is in some respects actually paltry,—so clumsily put together that we perceive the Ionic façade to be merely stuck on to a brick building of a very ordinary, workhouse-like appearance, was nearly enough to put us out of conceit with the Museum as a building, and with Sir R. Smirke as an architect. To that mortification, however, Mr. Fergusson now adds, by proving—and he does so by examining it room by room—that it is as defective, and as badly contrived for its purposes, as it well could be. Strange to say, however, Mr. Fergusson entirely exculpates the architect himself, by *affecting* to consider him as compelled to act, and therefore acting merely according to the directions given him by the trustees. Yet their instructions could have been no more than general ones, in complying with which it was for the architect to show artistic *forte*, and his skill in overcoming untoward circumstances, whether arising from matter-of-fact obstacles, or from the caprices and obstinacy of his employers. Mr. Fergusson would, apparently at least, make out Sir R. Smirke to have been all along no more than a sort of clerk of the works, acting under the immediate direction and dictation of the Trustees; and if Sir Robert now chooses to avail himself of that loophole, by coming forward and saying that such was actually the case, and that officiating as a mere clerk of the works, he has pocketed about 35,000*l.*—why well and good. Until he does so, he must bear the brunt of criticism,—and it surely is the very least he can do in return for a quantum of remuneration, which is otherwise excessive and enormously disproportioned to what he has actually done. How far the whitewashing here bestowed on him has helped to improve the architect's appearance in the eyes of the public, may be judged when Mr. Fergusson says, among a good many other somewhat bitter things, that "the Museum could have been better done for *one-sixth* of what has been expended on the present building!" If his calculations be correct, the seven dwelling-houses alone (which are very injudiciously thrust forward as external wings, and thereby mar the effect of the colonnaded façade) cost 80,000*l.*, or between 11,000*l.* and 12,000*l.* a piece; which reckless extravagance has not even consistency to excuse it, because, with the exception of the front and its colonnades, the exterior of the Museum itself is merely of brick, and withal makes not the slightest pretension to architectural design,—perhaps because Greek columns compose the alpha and omega of Sir R. Smirke's science; therefore as he was not allowed to envelope the whole structure with them, he dropped design altogether when he got to the corners of his front.

Although the mischief which has actually been done, cannot now be undone, Mr. Fergusson's "Observations" are likely,—

* "Observations on the British Museum, National Gallery, and National Record Office; with Suggestions for their Improvement." By James Fergusson, M.R. I.B.A., author of "An Historical Inquiry into the True Principles of Beauty in Art," &c. &c. With two plans. London: J. Weale.

because calculated—to do a great deal of good; first, by opening the eyes of the public, and warning them to inquire into similar matters *before* mischief be committed; and in the next place, by convincing those who have the management of such matters, that, though they may be *de facto* irresponsible for their doings, and may ward off from themselves public animadversion, they cannot act with complete impunity, but must, in the long run, pay for their whimsiness and favouritism, by having public censure inflicted upon their doings, if not directly upon themselves; they themselves, being screened from it by the impersonality of a collective body.

Without exactly subscribing to every one of the remarks and opinions contained in Mr. Fergusson's brochure, we admire and applaud his fearless and uncompromising exposure of unpardonable mismanagement of public buildings that ought to be a credit to the nation, more especially as they have been paid for, and that at an excessive rate. There is not, perhaps, in the whole country, another man who would have ventured to come forward and speak out with the same degree of freedom and boldness; and so far, Mr. Fergusson has distinguished himself most honourably. Most assuredly he has set an example very much needed—that of speaking out plainly, and very forcibly, too, where nothing less than such exposure will ever correct the abuses which are now so rife in the management of buildings which the country has to pay for. Those employed upon such works, too, ought to be prepared to meet criticism, just as well as any other class of artists, or even a great deal better;—because, as far as that vital part, their breeches-pocket, is concerned, success or failure is just the same.

If nothing else requires to be reformed in the present system of architectural practice, one abuse there is, which is not adverted to at all by Mr. Fergusson, and that is, the allowing architects to profit by their own mistakes—or perhaps intentional deceptions. Estimates would not be so grossly exceeded as they now frequently are, were it made, as in all fairness it ought to be, an imperative rule, that an architect should be entitled to no farther commission than upon the sum set forth in his own original estimate, in which he ought to make due allowance for unforeseen contingencies. Were such wholesome rule to be acted upon, the Houses of Parliament,—which, by-the-by, Mr. Fergusson scruples not to call a failure also,—would not have already cost Two Millions, when Mr. Barry's estimate for them was under 800,000*l.* An excess of 100,000*l.* might have been winked at; but an excess of Twelve hundred thousand and odd pounds, and an odd penny to boot, is, as the late Lord Liverpool would have said, "really too bad!" If that same odd penny does not partake of the farcical, or rather is not downright farce altogether, we know not what is. Surely, as some of our contemporaries have said, it is now full time to stop—at least to pause—and to leave to the next generation the task of completing, should they think proper, so enormously—we had almost said so shamefully, dear a pile.

Mr. Fergusson threatens us with—at least prognosticates that there will ere long be a demand for—another costly affair, namely, a new Palace. Now, Heaven forfend! What with first building them, and then patching them up, John Bull has paid enough for palaces already. With no sort of regard to decency, could it now be proposed to erect another building of the kind, just after 150,000*l.* has been expended in *improving* Buckingham Palace. Improvement, it must be confessed, there keeps within doors, but it will perhaps come out and show itself as soon as the marble arch takes its departure. Where it is to go to is not even yet decided; although that might have been done very long ago, Mr. Blore's plan having from the very first decided that go it must. If newspaper *on dits* are to be trusted, it is likely to be removed to Windsor, where it will be like a turned-off servant—*out of place.* Various sites have from time to time been suggested for it, and we think that the very best of them all

is the one lately proposed in the *Athenæum*, namely, the front of the Museum; that is on the site of the present gateway where it is intended at all events to have some kind of structure as a porter's lodge, into which the arch might very easily be converted without other alteration than that of closing up the side passages, and making the two smaller arches handsome recesses for the sentinels on guard, instead of having the paltry wooden sentry-boxes which now disfigure and disgrace the entrances to our Palaces and Government buildings. As to any doubt how the arch would show itself in front of the Museum, that may easily enough be dispelled by merely having a perspective drawing—or rather two or three such drawings from different points of view—made of the Museum and the arch so combined; and unless we are greatly mistaken, the arch would materially help the building by grouping with it picturesquely, and breaking up the stiff monotony of the colonnades, and counteracting that "cold and unartistic" appearance which Mr. Fergusson complains of. Though we thus return again to Mr. F., we can now only take leave of him with our most hearty thanks for his excellent "Observations," which we trust will not have been thrown away upon those who act as guardians to John Bull, in matters of taste, and who have the fingering of his money.

FAIRBAIRN'S "CONWAY AND MENAI TUBULAR BRIDGES."*

We owe the early appearance of this great work—in any case a most welcome one—to the unfortunate difference of opinion which is known to exist between Mr. Fairbairn and Mr. Robert Stephenson regarding their respective shares in the invention of the tubular bridge system, of which the Conway and Menai Bridges are the first, and will probably for ever remain the most remarkable specimens. Mr. Stephenson has boldly and unreservedly claimed for himself the entire merit, of having not only first conceived the idea of constructing a tubular bridge, of such huge dimensions as to allow the passage of locomotive engines and railway trains through the interior of it, and of such length as to span distances of from 400 to 500 feet, but of having satisfied himself by laborious investigation and calculation of "the perfect feasibility of the work" before consulting any one else on the subject; and he has assigned to Mr. Fairbairn, in a very slighting fashion, the place of a mere after-adviser—of one who, in common with two other gentlemen (Mr. Eaton Hodgkinson and Mr. Edward Clarke), but not more than either of them, assisted him in working out the theory which he "first broached." Mr. Fairbairn maintains, on the contrary, that the idea of the tubular bridge, though it unquestionably originated with Mr. Stephenson, was in his hands nothing more than a crude conception, very hesitatingly entertained, until he (Mr. Fairbairn) was called in to work it out, and that it has been mainly owing to his determined perseverance in the execution of the task confided to him, and to his numerous and elaborate experiments, that "the true principle on which tubular bridges should be constructed has been established, and Mr. Stephenson's original conception successfully carried into execution."

"At the period of the consultation in April, 1845, there were no drawings illustrative of the original idea of the bridge, nor had any calculations been made as to the strength, form, or proportions of the tube. I was asked whether such a design was practicable, and whether I could accomplish it; and it was ultimately arranged that the subject should be investigated experimentally, to determine, not only the value of Mr. Stephenson's original conception, but that of any other tubular form of bridge which might present itself in the prosecution of my researches. The matter was placed unreservedly in my hands; the entire

* "An Account of the Construction of the Britannia and Conway Tubular Bridges. With a complete History of their Progress, from the Conception of the original Idea to the Conclusion of the Elaborate Experiments, which determined the Exact Form and Mode of Construction ultimately adopted. By William Fairbairn, C.E., Memb. Inst. Civil Engineers, &c." pp. 291. Royal 8vo. With numerous Plates.

conduct of the investigation was entrusted to me; and, as an experimentor, I was to be left free to exercise my own discretion in the investigation of whatever forms or conditions of the structure might appear to me best calculated to secure safe passage across the Straits." p. 3.

The better half of the volume now before us is occupied in making out, by documentary evidence, the case set up by Mr. Fairbairn. We have read it carefully, and not, we must confess, without strong prepossessions in favour of the inculpated party, and an anxious wish to find that Mr. Fairbairn must have, somehow or other, deceived himself with respect to the extent of his claims. We feel honestly bound, however, to say, that the perusal has left us convinced, in spite of all prepossessions and leanings, that Mr. Fairbairn has not received at Mr. Stephenson's hands that justice to which he was entitled, but, on the contrary, has been treated most ungenerously and ungratefully. We will not say, that but for Mr. Fairbairn, the tubular bridge idea would never have been carried out into practice, for that would be, to assume that he engrossed in his single person all the practical skill of the country; but looking to the facts of the case as they stand, and as we see them established in the volume before us, beyond all possibility of dispute, we hesitate not to affirm, that it is more owing to Mr. Fairbairn than to any one other individual whatever—not excepting Mr. Stephenson himself—that it is now the triumphant reality which it is. Another might possibly have done the part which fell to the lot of Mr. Fairbairn as well; but none could possibly have done it better. He conceived and directed all the preliminary experiments—all, at least, with an exception or two, which were of any practical value—exhibiting therein a combination of philosophical painstaking with mechanical skill and ingenuity, such as is not often witnessed; he finally settled the form which it was best to give to the tube, and arranged the whole of the executive details; he personally superintended the construction of the Conway Bridge, which, our readers are aware, is but the Menai or Britannia Bridge on a smaller scale; and he only retired from further co-operation with Mr. Stephenson in the affair, when nothing new was left to be discovered or achieved. The motives for his retirement are thus very fairly and temperately stated :—

"I have now brought down this correspondence to the period when my official connection with the Chester and Holyhead Railway Company as engineer for the construction of the tubular bridges may be said to have virtually ceased; and I should willingly have passed over in silence the remainder of the events which transpired, were it not that the completeness of the narrative, as well as the justification of my conduct, demand some explanation independently of the regret which I experienced in withdrawing from an undertaking to which I had devoted so much time and thought—an undertaking fraught with the greatest interest, and which had, as it were, grown up in all its magnificent proportions under my own directions—I can truly say that the disagreement which took place with Mr. Stephenson is on my part much deplored. But I trust that the reader of the foregoing pages will, at least, have arrived at the conclusion, that I had taken the most important part of developing, and in giving a practical form to Mr. Stephenson's idea; and also in the superintending the construction and erection of the first Conway tubes. The fact is, I laboured almost incessantly in devising plans, or in watching over the practical details of the work, from the day on which Mr. Stephenson's suggestion was communicated to me until the close of my engagement; and I can sincerely say that I was always actuated by the principle of leaving nothing undone which could in any way contribute to the successful accomplishment of the undertaking. Regardless of the prognostications of failure with which the scheme was assailed, and in despite of the opposition of those whose assistance I had solicited, I uniformly advocated the peculiar principle on which the Conway Bridge has been constructed.

"Such being my position, and viewing the extent of services I had rendered, it will, I think, be generally allowed that it was very natural that I should desire to have my name publicly associated with Mr. Stephenson's as joint engineer for these bridges. Indeed, it may very fairly be said, that I might have ventured to claim this distinction, since it had been conferred upon me by the Board of Directors on Mr. Stephenson's own recommendation. If, instead of success having crowned our efforts, failure had unfortunately ensued, would not my reputation have suffered as well as Mr.

Stephenson's? The working plans having gone forth with my name alone attached to them, and from my being recognised as the acting engineer, might not the whole blame have been conveniently thrown on me in case of failure?

"It was not, however, on any of these grounds that I was induced to resign my appointment; for there had not then occurred any opportunity where I conceived it necessary to have my position publicly recognized; and I had always believed that when the proper time came, Mr. Stephenson would be the first to establish that position, and acknowledge the services I had rendered. The recognition was, however, very shortly afterwards denied me. The first Conway tube having been completed, and the success of the principle established, I conceived that the construction of the remaining tubes simply required a close attention to the system of construction already adopted, and therefore might safely be entrusted to those gentlemen whose constant presence during the building of the first tube had rendered them thoroughly acquainted with the whole details of the work. By such an arrangement, moreover, the Company would save the amount which had hitherto been paid for my services, and I should be enabled to devote my time to other pursuits which I had neglected for this work, and which now urgently demanded my attention. This was one reason for my retirement; but what chiefly led me to this decision, was the position assumed by Mr. Stephenson, his public misrepresentation of the position I held under the Company, and his endeavour to recognize my services as the labours of an assistant under his controul, and acting entirely under his direction. Had Mr. Stephenson, in his public address, done me the justice to state my independent claim to some of the most important principles observed in the construction of the tubes, I might perhaps have continued my services until the final completion of the whole undertaking; and, most assuredly, this work would never have come before the public. I now appeal to the preceding pages of this narrative, whether Mr. Stephenson's assertions are borne out by the simple statement of facts? I have overstated nothing, concealed nothing, and the reader is left to draw his own conclusions from these facts, after having become acquainted with the course pursued by Mr. Stephenson; which I will, in conclusion, concisely relate." p. 171.

Mr. Fairbairn proceeds then to give an account of a public dinner to celebrate the completion of the Conway Bridge, which took place on the 17th of May, 1848; on which occasion it was Mr. Stephenson first openly assumed that position in regard to Mr. Fairbairn and the undertaking, which has made the present appeal to public justice necessary. Mr. Stephenson's speech was confessedly a studied affair—he had announced beforehand that he would avail himself of the opportunity of "*setting the question at rest;*" but for all that it does not take Mr. Fairbairn many words to demolish it utterly.

"The inaccuracies, both as to facts and dates, in this statement of Mr. Stephenson, are very numerous. It simply requires a reference to the short description of the Ware Bridge, p. 113, and to the drawings,* to disprove the assertion, 'that it is a *thin tubular bridge*, although not precisely the same as the present, *yet in principle precisely the same;*' and it can easily be shown, too, that considering the Ware Bridge as a simple girder bridge, it is exceedingly defective in design. Is there anything new in this application of wrought-iron plate girders? As well might it be said that the combination of wrought-iron deck beams, so many years applied in iron ships for the support of the decks, is a 'counterpart of the proposed cellular top for the Britannia tubes.' I really cannot but regret that Mr. Stephenson, whose name will be always associated with the grandest bridge that has ever been constructed, should have committed himself in making such an erroneous assertion as that it was by reviving and extending his original conception of this imperfect structure at Ware, that he was led to originate the bridges crossing the Conway and Menai Straits.

"Mr. Stephenson's remarks further admit of the disingenuous construction that his scheme was matured before the Bill for the Chester and Holyhead Railway was passed by Parliament, and before I was consulted, and that he was at that early period acquainted with the present design of the bridge. He refers to the incredulous glances which were directed towards him when the *description of the bridge* was explained to the Committee; and intimates, that 'it was not until the Bill had been obtained, and it became necessary to commence, that he requested my assistance.' Now, my advice was asked by Mr. Stephenson before his evidence to the Parliamentary Committee was given, and he announced his idea to that Committee strengthened by more than one opinion of its feasibility. Let the reader turn again to the earlier letters of the correspondence, and he will find of what a crude and dangerous scheme that idea con-

sisted; how totally dissimilar in form and principle it was to the present tubular structures, and how slowly Mr. Stephenson was persuaded to give up his earliest conceptions. Again; Mr. Stephenson states that he has called in the aid of Mr. Hodgkinson and myself at the same time; now it is essential to the proof of my claims that this assertion should be explicitly contradicted. It was I, and not Mr. Stephenson, who solicited Mr. Hodgkinson's co-operation, and this was not done until I had been actively engaged for several months in my experimental researches, and after I had discovered the principle of strength which was offered in the cellular top, and not only proved the impracticability of Mr. Stephenson's original conception, but had given the outline of that form of tube which was ultimately carried into execution.

"When Mr. Stephenson had made up his mind to claim in the manner he did the whole merit of the undertaking, it is not difficult to understand his reason for giving Mr. Clarke—his own assistant—so prominent a position. I willingly bear my testimony to the great value of the services rendered by Mr. Clarke, to his talents, and to the great energy which he displayed in working out his several duties, but these had no reference whatever to the designing of the structures." p. 178.

There is one part of the case on which we think Mr. Fairbairn does not insist enough, though, in our judgments, it is of itself decisive of the inordinateness of Mr. Stephenson's pretensions. Mr. Stephenson and his friends, for obvious reasons, slur it over altogether. We refer to Mr. Fairbairn's *appointment to be joint engineer along with Mr. Stephenson to the Conway and Britannia Bridges*. The evidence of this is a Minute of the Board of Directors of the Chester and Holyhead Railway, dated 13th May, 1846, which we here quote at length from the work before us:—

"Resolved—1. That Mr. Fairbairn.... be appointed to superintend the construction and erection of the Conway and Britannia Bridges, in conjunction with Mr. Stephenson.

"2. That Mr. Fairbairn have, with Mr. Stephenson, the appointment of such persons as are necessary, subject to the powers of their dismissal by the Directors.

"3. That Mr. Fairbairn furnish a list of the persons he requires, with the salaries he proposes for all foremen or others above the class of workmen.

"4. That advances of money be made on Mr. Fairbairn's requisition and certificates, which, with the accounts, or vouchers, are to be furnished monthly.

"5. That the Directors appoint a book-keeper at each spot, the Conway and the Menai."

To talk, after this, of Mr. Fairbairn's being only entitled to a secondary and subordinate place in the affair, is to outrage all truth and propriety.

We can but regard with profound pity the hallucination which has betrayed a man of Mr. Stephenson's genius and worth (this unfortunate episode notwithstanding) into so false a position.

We do not overlook that we have as yet Mr. Fairbairn's statement of the case only, and that we may expect to see, ere long, something of a very opposite complexion from Mr. Stephenson or some of his friends. We shall give all due consideration to any such counter statement when it comes before us; but so well is all Mr. Fairbairn says borne out by written, and therefore unalterable proofs, that we do not, in the meanwhile, hesitate to avow our firm belief, that nothing which can possibly be adduced in the way of either evidence or argument, can ever alter materially the conclusion at which we have already arrived.

The purely scientific portions of Mr. Fairbairn's work, we must reserve for future consideration.

MR. DERING'S METHOD OF GIVING UNIFORMITY OF MOTION TO ELECTRIC CLOCKS AND TELEGRAPHS.—MR. DERING IN REPLY TO MR. HISLOP.

Sir,—Had Mr. Hislop examined more closely the engravings and description of the arrangement "for giving uniformity of motion to electric clocks and telegraphs," proposed by me in the Number of your Magazine for May 26th, he would have perceived that the force by which the pendulum is moved is not "divided into two equal parts;" for the coil, a^1, moving between the poles of the magnets,* is acted

* It is almost needless to remark, that if the common arrangement for breaking and renewing the current were employed, the position of one of the magnets would require to be changed, so that its *n* and *s* poles should face the reverse ends of the other magnet. The form of contact-breaker necessary in the arrangement shown in the engraving, must be obvious to all who are acquainted with electro-magnetic apparatus.

upon by four poles, that is by double the power exerted on the retarding coil marked *a*, which is placed outside, and therefore influenced only by one pole of each magnet. If the *n* pole of each magnet were removed, equilibrium must of course result, but not in the arrangement described.

My illustration of a lever has, I think, been misunderstood. If a weight of 1 lb. be placed at each end of a balance, the quantity of any substance raised at one extremity by a 1 oz. weight at the other, would be the same as if the heavier weights were removed. I am, Sir, yours, &c.,

GEORGE E. DERING.

July 2, 1849.

ANCIENT WORK ON MECHANICS.

Mr. Ewbank, in his valuable work on Hydraulics, page 285, refers to the celebrated work of *Ramelli*, and states that he had not been able to procure a copy of the work. It may be a public service to mention that a copy of this rare work, originally belonging to the Library of the Jesuits at Quebec, which was purchased at its sale when the Order was suppressed, after the capture of Canada by the English, subsequently fell into the hands of the late Simeon De Witt, and was sold a few years ago by me to the Patent Office. It is the only copy of the work that I have ever heard of as being in the United States, and is an extraordinary exposition of the advance of mechanic art at its era.

The work is in folio, 338 pages letterpress, duplicated, and contains Italian and French descriptions of 195 different engines or combinations of engines in military or isometrical perspective, delineated perfectly and lucidly; each engraving, folio page, devoted to a separate engine or machine, ornamented with appropriate embellishments of building, landscape, or fortress, with men and animals in proper position of service in connection with the subject of the drawing.

The frontispiece represents the author in military undress at a table, with his dividers in hand, measuring the plot of a fortress on a plan lying before him, the picture being completed by engineering instruments, armour, &c.

The title page is:—" Le diverse et artificiose machine, del Capitano Agostino Ramelli, del ponte della Tresea Ingegniero del Christianissimo Re di Francia et di pollonia. Nelliqualli si contengono varii et industriosi monumenti degni degrandissima speculatione per caverne beneficio infinito in ogni sorte d' operation. Composto in lingua Italiana et Francese. Aparagi in casa del autore co privilegio del Re. 1588."—*Scientific American*.

W. H.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 5TH OF JULY, 1849.

MOSES POOLE, London, gentleman. *For improvements in the manufacture of heels for boots and shoes, of swivels, of bag fastenings, of revolving furniture, and of the connection of pipes for gas and other fluids.* (Being a communication.) Patent dated December 28, 1848.

The improvements sought to be secured under this patent consist in making the two pieces of attachment with male and female screws, so that the thread or worm of the male screw may pass above that of the female screw, and serve as a stop to prevent disconnection, unless when turned in the reverse direction with a backward motion.

Claim.—Making the screw fastenings of heels for boots and shoes, of swivels, of bag fastenings, of revolving furniture, and of the connection of pipes for gas and other fluids as before described.

WILLIAM DINGLE CHOWNE, Connaught-place West, M.D. *For improvements in ventilating rooms and apartments.* Patent dated December 28, 1848.

Dr. Chowne states that his invention consists in the application to the ventilation of apartments of the syphon, placed with the legs upwards, which will have the effect of causing the atmospheric air to descend the lower leg and escape through the upper leg—the reverse of what takes place when the syphon is immersed in water or other liquid. For this purpose he proposes to employ the chimney as the long leg, and to construct a channel in the wall, or to affix a pipe thereto, which opens into the bottom of the chimney and into the apartment at top. The fireplace is, of course, kept closed by a screen or the tap of the registry stove. The short leg of the syphon may be fitted with one or more branch pipes, and may have the end, opening into the room, concealed by an open cornice, or it may be hidden by, or made to form part of, the architectural ornaments of the room. When fixed gas or oil lamps are employed, separate pipes are used to convey the products of combustion to the chimney. The same principle is proposed to be applied to the ventilation of mines.

Claim.—The patentee does not confine himself to the precise details of the specification, so long as the peculiar character of his invention is retained, and the principle of what he calls the "Atmospheric Syphon" is applied by suitable apparatus or means to the ventilation of rooms or apartments.

CHARLES LOW, Roseberry-place, Dalston, gentleman. *For improvements in smelt-*

ing copper ore. Patent dated December 28, 1848.

This invention consists in the introduction of currents of atmospheric air into the smelting furnace, so that they may pass above the metal and below the flames. The air being thereby decomposed, and parting with its oxygen, facilitates the separation of the copper from its oxide.

The currents of atmospheric air may be introduced through apertures constructed in the bridge or in the sides of the furnace.

No claims are made in this specification.

GEORGE FERGUSSON WILSON, Belmont, Vauxhall, gentleman, and CHARLES HUMPHREY, Manor-street, Old Kent-road, merchant, *for improvements in the production of light by burning oleic acid in lamps, and the construction of lamps and manufacture or preparation of oleic acid for that purpose.* Patent dated December 28, 1848.

The patentees remark that oleic acid, which is produced in the manufacture of stearic acid by the saponification of fatty matter, and known in commerce as tallow oil, contains so many impurities as to render it unfit for burning in lamps, and is moreover so easily decomposed by the heat of the burner tube, as to produce a thick pitch-like substance, which has the effect of extinguishing the light. Now the object of the present improvements is; *firstly*, to purify the oleic acid, by mixing with it dilute sulphuric acid, and agitating it, without, however, applying heat, as has hitherto been customary, and redistilling it, whereby the acid will be obtained in a state of great purity; *secondly*, to maintain a portion of the wick between the bottom of the flame and the top of the burner tube, unblackened, to prevent the heat of the flame from decomposing the oleic acid, so as to produce the thick pitch-like substance before mentioned, by the employment of a plate, with a central hole, which is placed over the wick, and has the effect of directing currents of air against the said part of the wick and upwards through the chimney.

No claims are made in this specification.

ISRAEL KINSMAN, late of New York, but now of Ludgate-hill, merchant, *for improvements in the construction of rotary engines to be worked by steam, air, or other elastic fluid.* Patent dated Dec. 28, 1848.

The improvements in rotary steam engines, described by Mr. Kinsman, have reference to engines of a peculiar construction, for which he formerly obtained letters patent. The characteristic feature of the engine is the employment of a fixed cylinder, and of a steam wheel rotating within it. The steam wheel is furnished with five pistons, connected together by packings, concave to the inside circumference of the cylinder, which is fitted with four steam stops, which are kept in constant contact with the periphery of the wheel, and provided with toes, or projections which embrace both sides of the pistons, and prevent the escape of steam. At each side of the cylinder there are two annular chambers which serve the purpose of steam chest and exhaust port. The steam stops are worked by cranks driven by toothed gearing from the shaft of the rotating steam wheel, so that they may be kept in contact with its periphery, and not worked by it. The cut off valves are worked by eccentrics, so that they may be governed by the motion of the steam stops.

The details of Mr. Kinsman's improvements could only be rendered intelligible by a careful collating of his two specifications, and for that we have neither space nor inclination.

Claims.—1. The mode of operating the steam stops, or abutments, by a crank motion derived from the rotation of the steam wheel substantially as described, when this is combined with a rotating wheel, the form of the periphery of which is such as would be generated by the motion of the steam stops which are kept in contact with the periphery of the piston wheel, but not operated upon thereby.

2. Making the ends of the steam stops with toes, or projections, which embrace the sides of the pistons and extend within the periphery of the piston wheel, when this is combined with the recesses or grooves, to prevent the escape of steam through them.

3. The employment, in combination with the rotating wheel, of cut-off valves, which are governed by the motion of the steam stops.

4. Packing the piston wheel, the steam stops, &c., with metal rings, provided with holes corresponding to the induction and eduction ports.

5. Packing the piston wheel by a metal ring, kept in position by means of adjustable screws.

WILLIAM KNAPTON, York, ironfounder, *for certain improvements in the mode of manufacturing gasometers or gasholders.* Patent dated January 3, 1849.

The object of these improvements in gasometers is to supersede the use of water tanks. The top and bottom of each gasometer is made of angle iron, to which iron plates are riveted; and the side is composed partly of iron and partly of some flexible material, rendered impermeable to gas, so that as the gas escapes the area of the holder may be

decreased. The bottom of the gasometer is supported upon cast-iron columns, and the top is suspended from weighted chains, as usual.

Claim.—The manufacturing of gasholders or gasometers of flexible and inflexible materials.

WILLIAM EDWARD NEWTON, Chancery-lane, C.E., *for certain improvements in steam engines.* (Being a communication.) Patent dated December 28, 1848.

1. The patentee states that his foreign correspondent has remarked, that in all beam steam engines, in which the steam is made to work expansively, the resistance of the impelled body does not decrease in proportion to the decrease of the pressure of the steam as it should do, in order to the economical application of the expansive principle. If the steam, he says, be cut off at one-fourth of the stroke, half the force of the steam will be expanded in driving the piston one-eighth of the stroke, while the crank will have been moved only one-third of a semi-revolution from the dead point; and the other half of the force of the steam will be expended in driving the piston the remainder of the stroke, and have to drive the crank through two-thirds of the semi-revolution. He therefore proposes to place the centre of the axis of the crank shaft in a plane nearer to the axis of vibration of the beam, instead of in a plane midway between a plane passing through the centres of the connection of the connecting rod at the extremities of each vibration, and a plane parallel to this one, and passing through the centre of the connection of the connecting rod when the beam is midway from the extremity of each vibration, that is to say, in the first plane. He further proposes to employ a pair of engines, the cylinder of the one being much larger than than that of the other, and having their pistons respectively connected to the short ends of two beams. The long ends of the beams are connected by rods, each equal to two and a half times the length of the crank, to two cranks keyed at an angle of 180°, upon a shaft, placed upon the principle before described. The steam enters the small cylinder at top from the boiler and drives its piston downwards, and, at the end of the stroke, communication is opened with the larger cylinder, into which steam passes and forces its piston down by its expansion only at the same time that communication is established with the bottom of the small cylinder, so that as its piston is moved upwards the pressure of steam on both sides is balanced. The bottom of the large cylinder communicates constantly with the condenser; and when its piston has arrived at the end of its stroke, communication is established between the top and bottom of the large cylinder and the bottom of the small one, so that when the piston of the latter is driven down the steam will be exhausted from its underside, so that it may encounter no resistance, and the piston of the large cylinder will move upwards in vacuo. The cut-off and slide valves are worked by eccentrics keyed upon the shaft, and possess no characteristic features that need description.

2. The improvements in steam engines employed in the propulsion of vessels, consist of certain arrangements for condensing the steam without allowing the condensing water to come into contact with the water of condensation, and are as follows: A number of tubes are inserted into two diaphragms, and supported in a horizontal cylinder. One of the diaphragms is attached to a flanch of the cylinder, so as to leave on one side a chamber between its head and the ends of the tubes. The other diaphragm is fixed to a conical ring attached to the cylinder, so as to leave a chamber on that side also. The object of this conical ring is to allow for the expansion or contraction of the tubes: the first chamber is divided into two by a horizontal partition, and the top portion communicates with the exhaust passages of the engine, and with the safety valve of the boiler, while the lower portion communicates with the air or feed pump. A rotary pump, worked by an auxiliary engine, independently of the propelling engine, draws the water from the outside through a pipe placed beneath the water line, and injects it at the bottom of the condenser, which is partially divided by a horizontal partition, so that the condensing water flows over the lower half of the tubes from front to back, and then from back to front over the upper half of the tubes, after which it escapes by an eduction pipe. The steam, whether from the exhaust of the engine or the boiler, enters the tubes, and as it flows through becomes cooled—the coldness of the condensing water increasing with the decrease of the temperature of the steam, until it at last becomes condensed and passes to the feed pump.

Claims.—1. Placing the centre of the axis of the crank, in beam engines where steam is applied expansively, nearer to the centre of the axis of vibration of the beam, on the principle before described, and for the purpose of obtaining a more regular mechanical force upon the crank from the expansion of the steam.

2. The use of two engines, having their cranks placed on a shaft opposite to one another, or at an angle of 180° when the crank shaft is located as described.

3. In expansion engines, having two cylinders and piston, one of which is acted on by the expansion of the steam alone, and has one of its ends in constant connection with the condenser, while the other is in alternate connection with the top and bottom of the smaller cylinder; so that as the steam acts upon the piston of the smaller cylinder, the piston of the larger one shall move *in vacuo*, and when the steam acts expansively upon the piston of the larger cylinder, it shall be in connection with the top and bottom of the small cylinder.

4. The combination of a condenser in engines used to propel vessels with a pump, which takes the condensing water from the outside, and drives it through the condenser, and which is worked by an auxiliary engine, independently of the propelling engine.

5. The double connection of the condenser; that is to say, with the exhaust of the engine and the boiler.

6. Connecting the tubes to the outer case or cylinder of the condenser by means of a diaphragm (in which one end of the tubes are supported), affixed to a conical ring or other suitable analogous means, to allow of the contraction and expansion of the tubes.

JOHN MITCHELL, chemist, HENRY ALDERSON, C. E., and THOMAS WARRINER, farmer, Lyon's Wharf, Upper Fore-street, Lambeth. *For improvements in smelting copper.* Patent dated December 28, 1848.

This invention consists in an improved mode of treating the sulphurets, carbonates, oxides, and sulphates of copper, however they may be combined together or with other metallic sulphurets, in order to obtain metallic copper therefrom. The patentees divide these substances into two classes, the first of which contains neither lime, baryta, strontia, nor magnesia, as a carbonate or salt, nor in the state of a sulphate; and the second, which does contain these substances. The classes are further subdivided into two orders, each according as they contain either more or less than 25 per cent. of copper.

Process for the First Class. — The finely pulverized ore is placed in a calcining furnace, where it is exposed to a gradually increasing heat, and kept constantly stirred from side to side to prevent the ore from agglutinizing. After a certain time, the ore is tested by a portion being withdrawn and mixed with water; and if, after settling, the water on being mixed with a solution of ammonia or, ferrocyanide of potassium, assumes a bluish or reddish tint, the roasting must be continued in order to drive off the sulphur.

Process for the Second Class.—The ore is roasted as in the preceding case, and then placed in a water tank with a false bottom, in order that the magnesia, &c., may be drawn off in a state of solution, leaving the ore undisturbed. The ore is again roasted and run into sand moulds or water.

When the ore is poor it is melted in a furnace with lime, or lime and old slag, and the regulus run out.

The reduction is effected in the following manner:—

When the ore contains 88 per cent. of oxide of copper, and the rest of oxide of copper, it is mixed with from 35 to 40 per cent. sand, and a sufficient quantity of carbonaceous matters to cause it to run easily when melted.

Claim.—Obtaining metallic copper ore from the ores of that metal by effectually separating the sulphur by roasting as described in process No 1, and by roasting and washing, and subsequently roasting, as described in process No. 2; and when the ore is poor obtaining a regulus without the use of an iron or alkali, and in separating the iron from the mixed oxides by the employment of siliceous and carbonaceous matters as described.

ROBERT JOBSON, Holly Fall Works, near Dudley, Stafford, engineer. *For improvements in the manufacture of stoves.* Patent dated December 28, 1848.

These improvements relate, 1st. To several modes of arranging polished metal surfaces with open stoves for the purpose of radiating the heat into the apartments, and permitting easy access to the chimneys and free passage for the smoke. 2nd. To a method of combining two or more grates in one stove. 3rd. To machinery for stamping or punching the reflectors out of sheet metal. And, 4th. To machinery for grinding and polishing them. The description is illustrated by 68 figures of reference, and would not be intelligible without them. The claims embrace the different combinations and modes of construction shown in the drawings.

HENRY FRANCOIS, Chelsea, Middlesex, engineer. *For improvements in sawing and cutting wood.* Patent dated Jan. 4th, 1849.

The present invention consists in constructing saws with the ordinary teeth and cutters, or "flem teeth" alternately in regular succession. The cutters are not under cut, and incline on either side alternately, while the teeth remain perfectly straight. It is proposed to employ a file let into a block, some eight or ten inches long, at a depth equal to the projection of the cutters, and which is worked to and fro. The saws, instead of working vertically, are to do so at an angle of 63°, and in cutting thin pieces of wood the log is moved to the inclined

saw, over a table which contains a groove, with inclined edges, through which the thin pieces of wood, when cut off, fall through, out of the way. To avoid irregularities in sawing a log with uneven sides into planks, straight and even pieces of wood are fastened to them, and rest against guide plates, so as to cause the log to enter the frame truly, and therein to maintain an even course. Lastly, the sawgate frames are to be supported upon springs sufficiently strong to lift them up.

No claims made.

William Gilmour Wilson, Port Dundas, Glasgow, engineer. *For improvements in the formation of moulds and cores of moulds for casting iron and other substances.* Patent dated December 30, 1848.

Claims.—1. A mode of constructing and working metal patterns.

2. The mode of manufacturing moulds by cutting them at parts to get at the internal patterns.

3. A mode of constructing moulds for cylinders and other castings, when the pattern is of a conical or taper form preceding a form with parallel sides, by forcing it through the sand; also a method of forcing or moving the patterns by hydraulic pressure.

4. Making the patterns of flexible materials.

5. Making the core-bars with joints or hinges, so that when drawn inwards towards the centre of the core-bars, they may collapse.

6. Making the core-bars in such manner that on the withdrawal of wedges from the internal and external parts, they shall collapse.

7. Making the cores with a spiral twist, and making the cores by remaining vertically between core-boxes and core-bars.

William Thomas, Cheapside, London. *For improvements in the manufacture of window-blinds.* Patent dated January 4, 1849.

Mr. Thomas's improvements in window-blinds are as follows:—

1. He proposes to manufacture the ladder-like webbing all in one operation, by weaving the longitudinal pieces in a loom suitable for weaving two pieces of cloth, and placing at their selvages a sufficient number of warp threads, which he interweaves at certain intervals with the longitudinal pieces, so as to form the cross or connecting pieces at suitable distances apart.

2. To manufacture blinds of any reticulated fabric, and to fill up the interstices with any suitable varnish, in order to prevent the injurious effects of moisture upon them.

3. To manufacture short window-blinds of a reticulated fabric, in imitation of those at present in use by printing or stencilling the necessary designs upon them in oil or water colour.

4. To manufacture window roller-blinds in the same way.

No claims are made.

David Yoolow Stewart, Montrose, ironfounder. *For improvements in the manufacture of moulds and cores for casting iron and other substances.* Patent dated January 4th, 1849.

The mould box is composed of four parts, placed one above the other, and is mounted on wheels, to run on a tramway over a pit, in which is a vertical screw rod, which gear into a female screw, cast in the centre of a horizontal plate. The screw rod carries a toothed wheel underneath the horizontal plate, and is driven by a pinion keyed upon a second vertical rod, also placed in the pit, from any suitable prime mover, so that the revolution of the screw rod causes the horizontal plate to travel up and down. On this plate are supported six, or any other number of rods, which each carry at top a patterns. The bottom of the mould box is furnished with a like number of holes, of sufficient size to fit closely round the pattern. The lower part of the mould box is filled with sand, rammed down, and the patterns caused to move progressively through it. The remaining portions are treated in like manner, except the last, which is filled with loam. The patterns are prevented from diverging in their upward movement from the perpendicular by means of a hoop slipped over their necks. When the patterns have arrived at the end of their course, they are removed, and cores substituted upon the rods in their places, which are lowered into position by the revolution of the screw rod and consequent descent of the horizontal plate. The melted metal is then run in.

The cores are moulded in some vegetable material, mixed with clay, upon fluted rods, and then forced through sand moulds, of less internal diameters than the external diameters of the cores, in order that their surfaces may be coated with sand. To avoid the necessity of lifting the moulds when they are to be dried, it is proposed to manufacture them on trucks, and to place tramways in the stoves, so that they may be wheeled into them. To withdraw the cores from large castings, Mr. Stewart employs hydraulic presses.

Claims.—1. The mode of forming several moulds at the same time, or one mould, by the use of patterns, to make move progressively through the mould box.

2. The mode of manufacturing and drying the moulds.

3. The mode of manufacturing the cores, and of withdrawing the core bars.

ROBERT MUNN, Stack-head Mill, Rochdale, Lancashire, cotton spinner. *For certain improvements in looms and apparatus connected with looms for weaving various descriptions of textile fabrics.* Patent dated January 4, 1849.

This invention consists in the application of one or more transverse horizontal rollers, coated on their peripheries with ground glass, emery, sand, bristles, or whalebone, &c., to the surfaces of cloth, in order to free them from "leaf," "shell," or other impurities. Or, the peripheries of the rollers may be of some smooth metallic substance, heated by any suitable means. The roller or rollers are mounted in suitable bearings in the framework of the loom, and driven from the tappet wheel by the action of a vibrating beam and catch, and through the intervention of endless bands. Where several rollers are employed, it is proposed that their peripheries should be coated with different substances of varying fineness.

Claims.—1. The application of a transverse roller to the surface of a fabric, coated on its periphery with ground glass, emery, &c., to free it from impurities, such roller working independently of the ordinary taking up movement.

2. The application of a series of rollers, coated on their peripheries, as before described.

3. The application of two or more rollers, coated on their peripheries with bristles, whalebone, &c.

4. The application of two or more rollers, coated on their peripheries with substances of different degrees of coarseness.

5. The application of polished metal rollers, heated by any suitable means.

IN THE QUEEN'S BENCH.

2nd July, 1849.

Before Mr. Justice Wightman and a Special Jury.

THE QUEEN *versus* CUTLER AND OTHERS.

This was a *scire facias* brought to repeal letters patent granted to Job Cutler on the 6th day of November, 1841, for an invention intituled, "Improvements in the Construction of the Tubular Flues of Steam Boilers." And it appeared from the opening statement of counsel, that several grounds were alleged for the repeal of the patent, amongst others, that the invention, or some part of it, was not a manufacture within the meaning of the exception in favour of patents contained in the statute made for suppressing monopolies, and, therefore, that the patent was void, as being contrary to the provisions of that statute.

The case had been previously tried (1st Dec., 1847) before Lord Denman; when his Lordship was of opinion that if any part of the invention was practicable, it was not material whether the other parts of the invention claimed in the specification were so or not; but his Lordship ruled that neither the third nor the fourth part of the invention could be made the subject of a grant by patent.

The Jury at that trial returned a verdict for the defendants generally upon all the points of the case; thus, in effect, overruling the opinion of the judge as to the third and fourth parts of the invention; and upon application to the Court of Queen's Bench, the verdict was set aside, the court being of opinion that it was not sufficient for the defendants to show merely that one part of the invention was practicable; and the case, consequently, now came on for a second trial.

Mr. Hindmarsh opened the pleadings, and the Attorney-General stated the case on the part of the prosecution, detailing the facts which we have mentioned.

His lordship having intimated that it was his intention to follow the same course as Lord Denman with respect to the 3rd and 4th parts of this invention (which, as claimed in the specification, are merely new applications of tubes which have been made or prepared according to the well-known processes, viz., the use or application of those tubes in the ordinary manner to form tubular flues), it was after some discussion amongst the counsel, agreed that a verdict should be taken for the Crown; that the 3rd and 4th parts of the invention are not subjects for a patent; the verdict, by consent, passing for the defendants upon the other parts of the case unless the Court should determine the questions respecting the 3rd and 4th parts of the invention in favour of the defendants, in which case all the questions in the cause must be again submitted to a jury at a fresh trial.

The effect of this will be, that if the Court shall determine that the 3rd and 4th parts of the invention are not subjects for a patent, judgment will be given to repeal the patent.

The Attorney-General, Mr. M. D. Hill, and Mr. Hindmarsh were counsel for the prosecution; and Mr. Serjeant Talfourd, Mr. Whitehurst, Mr. Henderson, and Mr. Webster for the defendants.

QUEEN'S BENCH.

Before Lord Denman—June 28, 1849.

The Queen v. Sievier.

This was a *scire facias* brought to repeal a patent grant to the defendant on the 12th day of July, 1847, for his invention, intituled, "An improved material or materials for purifying or decolorizing bodies, *and which material or materials may also be employed as manure and pigments, and for other like purposes.*" A few days before the time appointed for the trial of the cause the defendant obtained leave to disclaim the latter part of the title, viz., the words we have printed in italics.

The prosecutor having by his writ of *scire facias* taken exception to the title of the invention, it became necessary for the defendant to plead such a plea as would enable him to set up the disclaimer as an answer to that part of the prosecutor's case. The cause being now called on, the Attorney-General appeared for the prosecutor, but Mr. Hindmarsh handed in the new plea (which is technically termed a plea *puis darreign continuance*), verified by the defendant's affidavit, and the further proceeding in the cause was consequently postponed to a future day.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal for May*, 1849.]

For an Improvement in Painting on Translucent Surfaces. *J. B. Hall.*

The patentee says,—"The nature of my invention consists in preparing plates of glass with a translucent coating, which will receive and retain dry colours, and also admit of the application of colours ground in oil, without spreading, while at the same time serving as a disperser of light; and in placing in the rear of the picture, executed upon the plate of glass thus prepared, a brilliant reflecting surface, which, acting in connection with the translucent coating upon the glass, will give to the picture a highly luminous appearance."

For an Improvement in Smiths' Bellows. *Morgan Loomis.*

The patentee says,—"The nature of my invention consists in providing the upper part of the bellows, or wind chest, with two perpendicular bellows or self-filling reservoirs, one on each side of the said wind chest, and forming the sides of the same, the outside plank or part being attached to the end of a leather strap passing over pullies immediately above the wind chest, and secured at its opposite end to a vertical standard connected to a weight fastened to the top of the wind chest, in such a manner that the pressure of the wind from the lower bellows will fill the wind chest, and raise the weight and slacken the straps, and allow the outside or moveable part of the upright bellows to open outward by their own gravity, causing said bellows to become filled with air; and when the pressure of wind from the bottom bellows is stopped, the weight in its descent closes the outer valves of the self-filling reservoirs, and presses the wind out of the same into the wind chest, and forces it through four or more wind or faucet-pipes arranged on each side, and communicating with the fires to be operated upon;—each of the before-mentioned reservoirs or bellows, being provided with suitable swinging valves for regulating the ingress and egress of the wind.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Greenwood, of Goodman's-fields, London, sugar-refiner, and Frederick Parker, of New Gravel-lane, Shadwell, animal charcoal manufacturer, for improvements in filtering syrups and other liquors. July 4; six months.

John Robinson, of Patterson-street, Stepney, engineer, for improvements in machinery for moving and raising weights. July 4; six months.

John Grantham, of Liverpool, engineer, for improvements in sheathing ships and vessels. July 4; six months.

Josiah Bowden, of Liskeard, linen-draper, and William Longmaid, of Beaumont-square, Middlesex, gentleman, for certain improvements in the manufacture of soap. July 4; six months.

Sir Francis Charles Knowles, of Lovell, Berks, Bart., for improvements in the manufacture of iron and steel. July 4; six months.

Richard Archibald Brooman, of 166, Fleet-street, for improvements in steam generators. (Being a communication.) July 4; six months.

James Mulbery, of Parkersburgh, United States, America, machinist, for certain improvements in the slide-valves of steam engines. July 4; six months.

William Henry Wilding, New-road, Middlesex, gentleman, for certain improvements in engines, and in obtaining and applying motive power. July 4; six months.

Robert William Thompson, of Leicester-square,

Middlesex, civil engineer, for certain improvements in writing and drawing instruments. July 4; six months.

William Bush, of Great Tower-street, London, civil engineer, for improvements in lamps and in lighting. (Being a communication.) July 4; six months.

John Combe, of Leeds, York, civil engineer, for improvements in machinery for heckling, carding, winding, dressing, and weaving flax, cotton, silk, and other fibrous substances. July 4; six months.

William Henry Brown, of Ward's End Wheel, at Wadsley, Ecclesfield, York, steel roller, for an improvement in rolls for rolling flat and half-round file and other iron and steel. July 4; six months.

Pierre Augustin Chauffourier, of Regent's Quadrant, merchant, for improvements in castors. (Being a communication.) July 4; six months.

John Browne, of Great Portland-street, Portland-place, Esq., for improvements in apparatus to assist combustion in stoves or grates. July 4; six months.

Henry Bailey, of Wolverhampton, Stafford, chemist, for certain improvements in the construction of articles of wearing apparel, which improvements are also applicable to fastenings for the same. July 4; six months.

Robert Weare, of Argyle-street, Birkenhead, clock and watch maker, and William Peter Piggott, of Wardrobe-place, Doctors' Commons, mathematical instrument maker, for certain improvements in electric batteries and in the production of light; also a mode of transmitting or communicating intelligence for the better protection of life and property; part of which improvements are applicable to other like purposes. July 4; six months.

LIST OF IRISH PATENTS FROM 20TH OF MAY, TO THE 20TH OF JUNE, 1849.

Elijah Slack, of Orchard street, Renfrew, North Britain, gum manufacturer for improvement or improvements in the preparation of materials to be used in the manufacture of textile fabrics. May 28; six months.

John Bethell, of Parliament-street, Westminster, for certain improvements in preserving animal and vegetable substances, and also stones, bricks, and articles made of clay and chalk, and plaister from decay. June 1; six months.

Alexander Munkittrick, of Manchester, merchant, for an improved composition of matter, which is applicable as a substitute for oil, in the lubrication of machinery, and for other purposes. (Being a communication.) June 2; six months.

Joseph Deeley, of Newport, Monmouth, engineer and iron founder, for improvements in ovens and furnaces. June 13; six months.

Robert Brett Schenck, late of New York, America, at present of Belfast, Ireland, manufacturer, for a machine for buffing and scutching flax, hemp, and other fibrous substances. June 18; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses	Subjects of Design.
June 28	1938	George Smith & John Kemp	Birmingham	Button.
"	1939	George Smith & John Kemp	Birmingham	Button.
29	1940	John Vickery Broughton & Co.	Cliff Works, near Wakefield	Pipe-moulding forceps.
30	1941	Edward Brooks & Son,	Birmingham	Water-tight nipple and percussion-cap.
July 2	1942	George Keith	Prince's-street, Leicester-sq	Machine for dividing ice, salt, &c.
4	1943	Dr. Ellis	Sudbury-park, Petersham	Graduated glass double aperient fountain.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the substance of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d.

CONTENTS OF THIS NUMBER.

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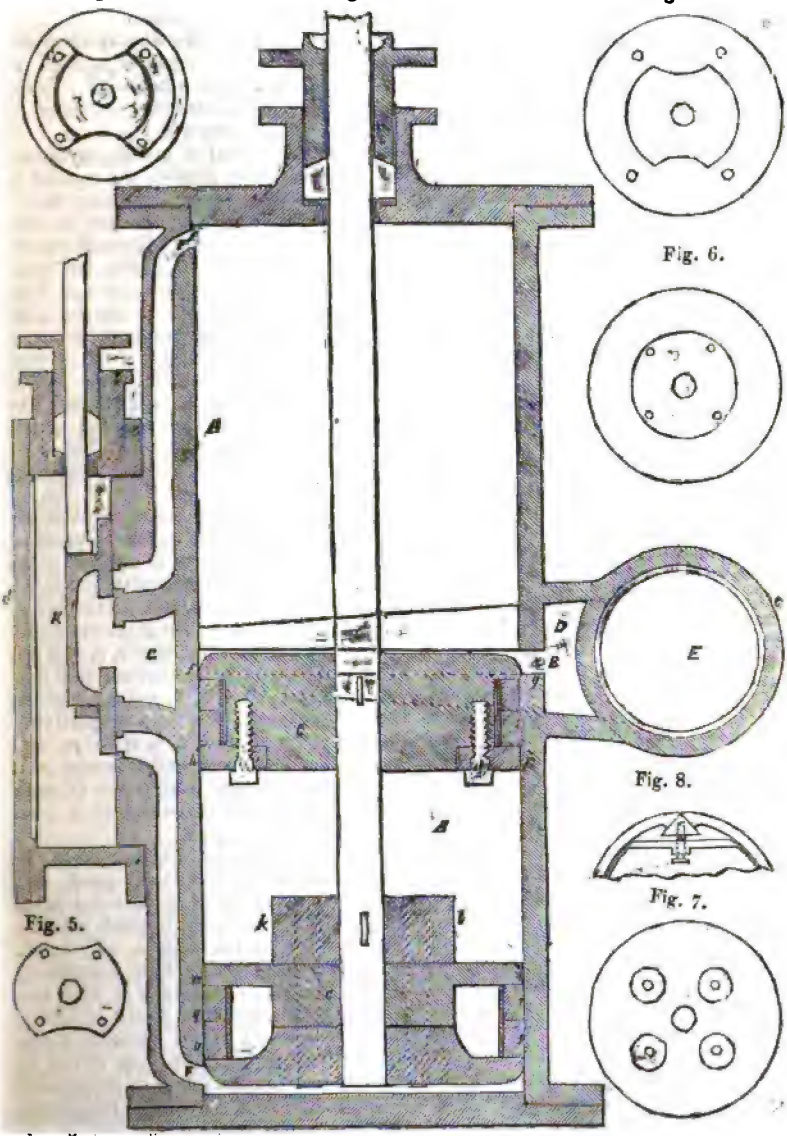
Edited by J. C. Robertson, 166, Fleet-street.

URWIN'S PATENT STEAM ENGINE IMPROVEMENTS.

Fig. 3. Fig. 1. Fig. 4.



URWIN'S PATENT STEAM ENGINE IMPROVEMENTS.

[Patent dated January 11, 1849. Patentee, Robert Urwin, of Ashford, Kent, Engineer. Specification enrolled July 11, 1849.]

Mr. Urwin's improvements are calculated, by the extraordinary advantages which they offer, to command general attention; and if these advantages are realized to but half the extent anticipated by the inventor, they will mark an era in the history of the steam engine. They embrace two main objects:—*first*, how to get the greatest possible effect from a given quantity of steam within a given time; *second*, how to get back that steam—recondensed, reheated, and re-evaporated—without waste, or at least with all such waste as may occur amply compensated for. And supposing these problems to be solved successfully, or even with only very partial success, we should be enabled to do by steam power, much that we have never been able to accomplish by means of it before—in ocean navigation and screw propulsion especially—and to obtain in all cases from it far better service, at much less expense.

First Branch.

Mr. Urwin observes that, "in the ordinary condensing or low-pressure steam engine, the motion of the piston is produced either by steam of low pressure (say from five to ten lbs. per square inch), or by means of the pressure of the atmosphere alone, acting on one side of the piston against a vacuum of more or less completeness, produced on the other by the condensation of steam; and that several attempts have been made to increase the efficiency of such engines by increasing the pressure of the steam (say to 15 lbs. and upwards), but without the proportional advantage anticipated—That in the ordinary non-condensing or high-pressure engine, the motion of the piston is produced solely by the pressure of steam; that is to say, by an inflow of steam of high pressure on one side of the piston acting against an outflow of used steam of less and constantly diminishing pressure on the other side, in which case, the force exerted on the inflow side is, of necessity, proportional to the velocity and completeness with which the clearance of the steam from the other or exhaust side is effected—And that both sorts of engine fall short of developing the full motive force due to the quantities of steam consumed by them respectively, owing to the slowness or imperfection of the methods employed to get rid of the air or steam on the exhaust sides of the piston."

Having cleared the way by these observations—to the truth of which no exception can be taken—Mr. Urwin proceeds thus to describe the scope of his first improvement:

"Now, the *first* of my improvements in steam engines consists of a method or system of effecting the clearance or exhaustion, whereby I am enabled to combine in one engine the advantages peculiar to both the condensing and non-condensing, or low pressure and high pressure engines, and to obtain from given quantities of steam within given times, a greater amount of work or duty than I believe has been ever before obtained from like quantities in the like times; and this without the aid of the ordinary air-pump.'"

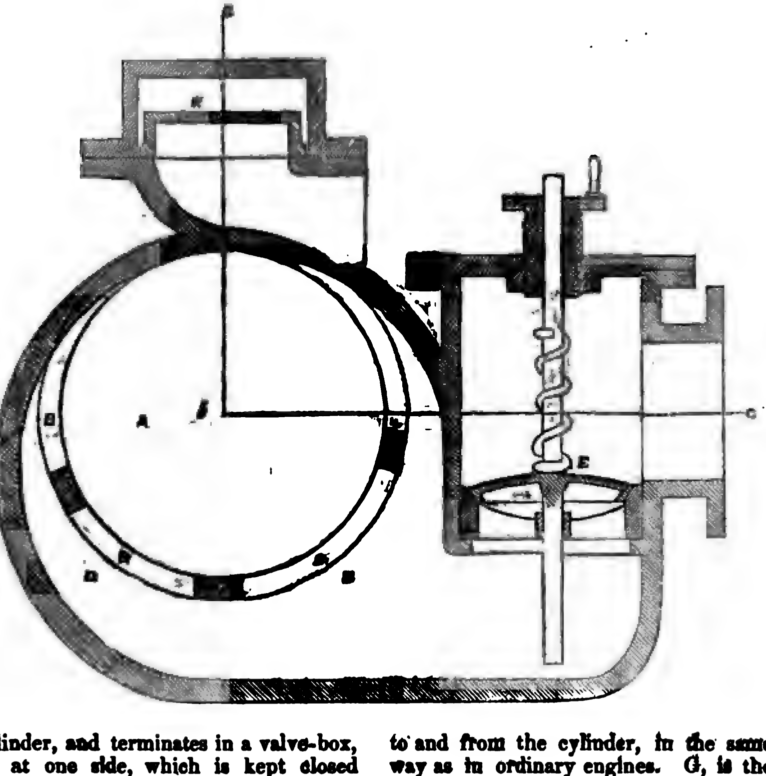
The details of the method or system then follow:

"Figs. 1 to 10, both inclusive, show the manner in which this improved mode of clearance or exhaustion is applied to an engine suitable for locomotive purposes. Fig. 1 is a vertical section of the cylinder and piston, and their immediate appendages, taken on the lines *a, b, c* of fig. 2, which is a cross section on the line *d, e*. Figs. 3, 4, 5, 6, 7, and 8 are plans of the piston on the lines respectively marked *f g, h i, k l, m n, o p*, and *q r*. Fig. 9 is a sectional elevation of a locomotive carriage, with a pair of such engines fitted to it; and fig. 10, a plan on the line *s t* of fig. 9.

"A, is the cylinder, which is longer in proportion to the stroke than usual, and instead of being entire in the sides from top to bottom, as usual, is made with an opening, B, at the middle, all round, with the exception of four connecting pieces or ribs, *v v* (see fig. 2;) C, is the piston, the constructive details of which are clearly shown in the sectional plans of it given in figs. 3, 4, 5, 6, 7, and 8. It is made of such a depth in proportion to the length of the cylinder, that when the piston has reached the end of its

stroke in either direction, the top or under part of it (as the case may be) shall just have passed clear of the middle opening, B, so as to allow the steam which was previously behind the piston to escape through that opening. To enable the steam to pass off all at once, and in one mass (as it were), and without the least delay or obstruction, the piston is rounded off at the top and bottom edges (as shown) so that the instant the part of the piston, which is squared or flush with the sides of the cylinder, passes the top or bottom edge of the opening, B (as the case may be), the entire opening is thrown open to the steam. D, is a jacket or casing which surrounds the middle opening, B, of the

Fig. 2.



cylinder, and terminates in a valve-box, E, at one side, which is kept closed against the atmosphere by a spring-stalk valve, E*a*, but yields readily to any pressure exceeding the weight of the valve. From this jacket or casing the steam, which rushes into it through the opening, B, may be either allowed to pass into the open air or conducted into the chimney of the locomotive, to act as a blast. F F^1, are two ports, one at the top and the other at the bottom of the cylinder, which serve alternately as inflow and outflow passages for the steam to and from the cylinder, in the same way as in ordinary engines. G, is the exhaust-passage, which leads to a small condenser, H, (not shown in fig. 1;) K, is a slide-valve box, which differs in no respect in its details from ordinary slide-valve boxes.

"The operation of the engine is as follows:—Let us suppose the parts to be in the position represented in fig. 1, that is to say, the piston at the bottom of the cylinder, the communication just about to open between the upper part of the cylinder, A, and the exhaust-passage, G,

Fig. 9.

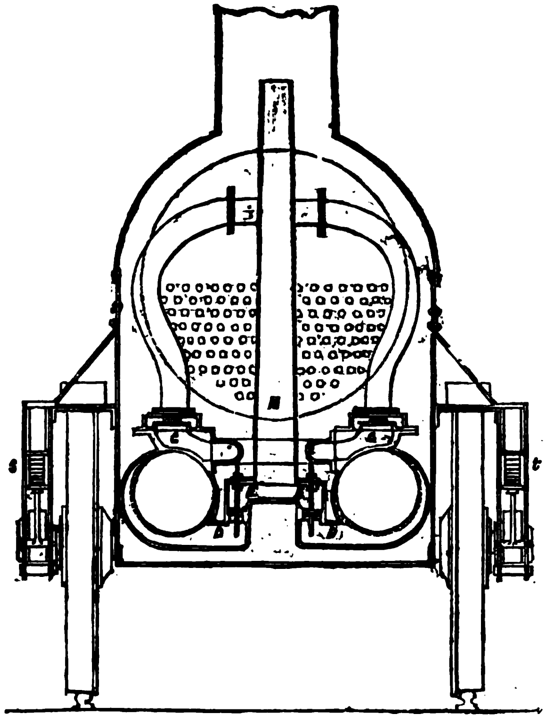
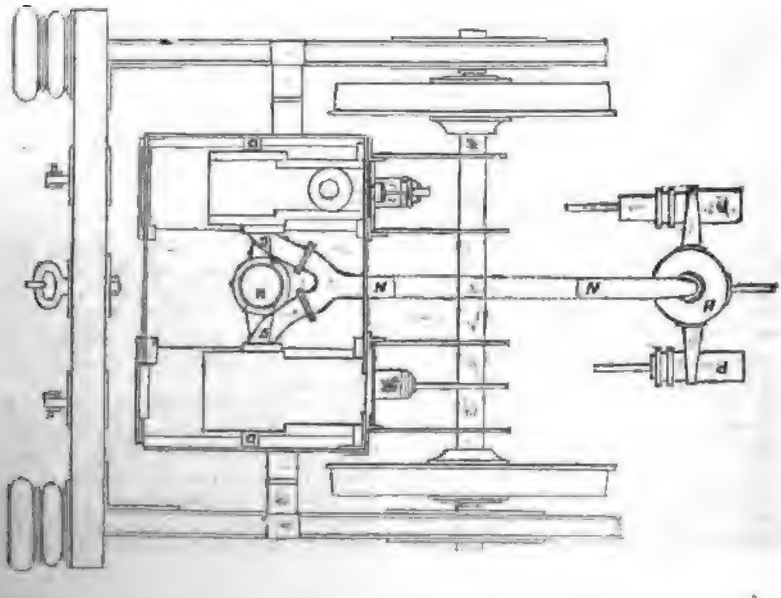


Fig. 10.



and the atmosphere shut out by the stalk-valve, E*a*; steam of a high pressure, say 50 or 60 lbs. per square inch, is then admitted beneath the piston, through the port, F, which drives up the piston against such vacuum as there may be on the other side to the upper end of the cylinder. As the under side of the piston passes clear of the middle opening, B, the steam which was beneath it rushes out into the jacket or casing, D, forces up the stalk-valve E*a*, and escapes into the atmosphere, or is conducted to the chimney, as the case may be; whereby the under part of the cylinder is almost entirely cleared of steam preparatory to the return stroke. Steam of the same high-pressure as before, is then admitted by the port, F′, above the piston (now at the top of the cylinder) and simultaneously therewith a communication is opened between the under part of the cylinder and the exhaust passage, G, so that any small portion of steam which may have been left in the under part of the cylinder may be drawn off to the condenser, H, and then condensed, and the vacuum rendered as perfect as it practically may be. And so the reciprocating action of the piston is kept up as long as steam is supplied to the cylinder; the clearance of the cylinder from steam on the exhaust side of the piston at each stroke being effected with a celerity and completeness never, to the best of my knowledge, heretofore accomplished.

"The proportions which the areas of the steam ports, F and F′, and the middle opening, B, should bear to those of the cylinder or piston, will vary with the speed at which it is desired to work the piston. I find in practice that the following proportions answer well for high velocities; namely, to allow for every twenty circular inches in the piston, one square inch for the steam ports, and three square inches for the middle opening. And in order that the engine may always have passed the centre, and the steam have made its escape through the opening, B, into the jacket or casing, D, before the communication is opened between the exhaust side of the piston and the small condenser, H, care must be taken that whatever lap is given to the outside of the slide the same lap shall be given on the inside, together with twice the lead that the engine is intended to have. When the stroke of the piston is longer than usual, I would also recommend the employment of a slide with a middle bridge to fill the ports.

"Where there are two engines worked in connection, (as in the locomotive represented in figs. 9 and 10), and it is desired to convey the bulk of the used steam into the chimney, in order to increase the draft, the two valve-boxes, EE, in which the jackets or casings, DD, terminate, are made to open into one common discharge-pipe, M, which is carried upwards into the throat of the chimney. The smaller portion of the steam which passes off through the two exhaust-passages, GG, is conveyed by a common receiving-pipe, N (see fig. 10), to the condenser, H, which is kept partly filled with cold water from the tender. The heated water which accumulates in the condenser is transferred to the boiler by the pumps, PP, or should more accumulate there than is needed for the boiler, the feed pipes are coupled together above the stop clack, and the surplus conveyed back to the tender.

"Should it be deemed advisable to increase the temperature of the water in the condenser previous to its being pumped into the boiler, this may be effected by screwing down, or giving less range to the springs of the valve-boxes, EE, which will necessarily cause a larger portion of steam to be left in the cylinder on the exhaust side of the piston at each stroke."

[The Second Branch of Mr. Urwin's improvements we shall give in our next.]

THE "CASE IN EVAPORATION."

Sir,—In Number 1349, p. 590, of your Magazine, I observed an article on "*The Case of Evaporation*," which contains certain fragments of a private communication which I had lately occasion to make on that subject. Your Number of the week following contains an answer to those observations by "F. B. O.," wherein he accuses me of higgling as to terms, and in the meam time losing sight of the principal question. A short recapitulation of my whole communication, however, will serve, I think, to show that my arguments bore directly upon "F. B. O.'s" original proposition,

and that only in self-defence I was obliged to enter into the definition of terms, and at the same time to protest against the veto of professed engineers who were evidently not familiar with the physical condition of steam.

The original proposition was essentially as follows:—*If steam of superior pressure and corresponding temperature mixes with steam of inferior pressure and temperature, will the former give off any heat to the latter, and thereby increase the performance of the boiler which produces it?* To this I answered distinctly in the negative, and supported my assertion by demonstrating that steam of superior pressure, if it were allowed to expand to the same level with steam of superior density (as would be the case in mixing them) would simultaneously lose its excess of temperature over the latter; if, on the contrary, steam of inferior pressure were compressed, its temperature would rise in the same proportion. These, indeed, are but consequences of the general law, that the sum of the latent and sensible heat of steam is the same under all circumstances.

I then entered into "F. B. O.'s" different points of argument separately, and finding that no distinction was made between sensible or latent heat, condensing or cooling heat, it was impossible to proceed with my refutation without defining the different meaning of these terms, although I readily admit that such definitions are better adapted to "Normal Schools."

In answer to the questions which "F. B. O." puts in his latest communication, I do say, that heat does radiate alike in all directions — that a surface of water in contact with heat is susceptible to its influence, although I am not prepared to admit "as susceptible as a surface of metal or any other solid"—water, unlike metal, being both a very bad conductor and a bad absorber of heat — that heat applied superficially will cause slow evaporation.—And finally, "that it would, properly speaking, make no difference whence that heat is derived," provided there is any really derived. But "F. B. O" continues, "whether from a red-hot plate of iron, from steam of greater pressure and higher temperature, or from superheated steam!" If this were granted it would indeed not be difficult to arrive at a whole train of novel conclusions; but unfortunately, I must protest that, in the second case no available heat is derived at all, for the following reason:—Heat cannot be abstracted from steam of any pressure and corresponding temperature without condensation taking place; in order to sustain the supposed evaporation from the surface of water, this condensation must go on continually; or, in other words, one and the same surface of water is supposed to generate and reabsorb vapour from its surrounding atmosphere simultaneously, which is an obvious contradiction. The case is, of course, quite different if steam of superior density is allowed to pass through pipes above the water surface. The pipes in this case act like rods of heated iron, which will cause the water below to evaporate, "if under an inferior pressure;" but for every lb. of water thus evaporated, condensation of at least 1 lb. of steam must take place within the pipes.

I am, Sir, your obedient servant,

G. D.

MR. ASTON'S DISTINGUISHING MARKS FOR LIGHTHOUSES.

Sir,—It seems advisable to recall attention to the plan for lighthouses proposed by Mr. Aston, (p. 601, vol. l.,) both for the purpose of setting him right and of reminding your readers of many serious objections which occur to one duly considering the whole subject. Mr. Aston, in his communication, does not make it clear, whether he supposes lighthouses to be lighted from one ring of lamps or from several tiers of them. He is evidently not well acquainted with the internal economy of our modern lighthouses; but I shall take both suppositions, and treat of them separately. Let us suppose, then, that we have but one circle of lamps to deal with. According to the new plan, part of the light is to be suffered to shine through coloured media, in place of being made use of in reflection.

Now, lighthouses with a single row of lamps are the weakest, and could least well afford to have half of their reflected light taken away. Also, remembering that every ray of light which is directed through the coloured medium is abstracted from the quantity available for reflection, and that this coloured light is

chiefly useful in foggy and foul weather, we are struck by the fact that we are diminishing the power of the light at the very moment when its intensity ought to be the greatest; and by thus splitting into two a light which in bad weather *might* be seen at some distance, we prevent its being of any use at all as a beacon. The engraving gives a very imperfect idea of the manner in which the light would be shut off from the coloured glass below. A circular partition must pass in direction through the centre of the light (if single); and to provide against diffraction this must be *of* some, say half-an-inch, thickness. And such an obstruction fixed in front of the light, will render it almost invisible over a large *annulus* of sea, at a time, too, the most inopportune of any.

If on the other hand the lighthouse be supposed to have a lantern containing two or three rows of lamps, (as is usual in the best-constructed houses,) we may observe at once that Mr. Aston's plan would merely amount to the colouring of one or more of these tiers of lamps, and so placing a shade as to conceal the coloured rays, except from ships within a certain radial distance from the light. Just so much light as is used for this coloured part is taken from the white general light, and unless the latter be already *too powerful*, we are diminishing the intensity for the purpose of assisting a few vessels, once perhaps in a year, in identifying the light.

Coloured lights placed at some feet below the main lantern are already used in some lighthouses, and many projects have been devised for using additional lights in aid of the verification of particular lighthouses.

As to the use of a vertical partition showing coloured light to ships on different sides of the lighthouse, Mr. Aston ought to be aware that this plan has long ago been adopted in very many instances. A partition may be used here and not in the case formerly spoken of, because the obstruction it offers represents a distance only in azimuth, quickly, of course, traversed by a sailing vessel, while the same obstruction placed horizontally requires a parallax perhaps of three or four miles to be traversed in an oblique direction. The distinguishing features of lighthouses must be some which are not equally with the main light subject to be misunderstood, and must not sacrifice the brilliancy of the light to any doubtful increase of the means of identifying its position.

I am, Sir, yours, &c.,
JOHN MACGREGOR.

Dublin, July 7, 1849.

PUBLIC BATHS AND WASH-HOUSES.

Sir,—The establishment of baths and wash-houses, in Goulston-square, has usually been spoken of in terms of unqualified praise, and certainly the general arrangement would, to a superficial observer, seem to warrant the encomiums passed upon it.

Some time ago I visited this establishment, and had an opportunity of carefully inspecting it, but was much disappointed with the details.

The chief object which the promoters of public baths have in view, is to benefit that class to whom the cost is of importance, and therefore the cheaper each bath can be rendered the greater will be the number who will avail themselves of them, and the more extensive the benefit conferred. In order to give cheap baths, economy must be observed, not only in the general management, but in the first outlay.

I have statistical data before me anything but favourable to the economics of this institution. I will not, however, at present enter upon this view of the subject, but confine my observations entirely to the mechanical details which are, as before observed, open to censure.

I will notice the defects in the order they occurred when passing through the building.

1st. *Water Supply.*—I was told that the water is supplied from the main under pressure (during the night) sufficient to carry it to the top of the building, yet notwithstanding it is received into a tank at the BASE of the building, and from thence lifted to supply the baths—the cold water by an engine erected for that purpose, and the hot by the pressure of steam upon the surface of the water in the boiler. This evidently causes an unnecessary consumption of fuel, for if the water be originally delivered with force sufficient to carry it to the top of the building, there can be no reason for lifting it. Apart,

therefore, from the original outlay for engine, pipes, &c., the daily cost for fuel, engine-man, &c., is considerable.

2nd. *Ventilation.*—The ventilation of the building is defective, and other means than that of opening the skylight should be devised, for this causes a large current of cold air to descend upon the bather, who on coming out of a hot bath may be thereby seriously injured.

3rd. *Manipulation.*—Many of the baths are emptied and filled through the same aperture, which is objectionable, inasmuch as hair, vermin, and other solid matter are liable in draining off to be carried into and adhere to the sides of the pipe, to be brought back again with the fresh water when it enters. The conical plug and simple cock, which are in use in the second-class baths, appear to me to be more efficient. The disc cock, to admit both hot and cold water through the same aperture, does not seem to act long efficiently; for both here and at St. Martin's leakage is great, the expansion and contraction caused by the hot and cold water being very liable to disarrange them. The baths are for the most part of enamelled iron; but the enamel soon wears off, and leaves the bath much discoloured, and of a very dirty appearance.

In the wash-houses similar defects are apparent, evidently the result of the plan not having been sufficiently matured before carrying it into execution. Neither the steam, nor the hot water pipes, nor the boiler are jacketed; hence the loss of heat from radiation is immense, and the base of the building is excessively hot. The small pipes leading to each of the wash tubs are very disproportioned to the pipes leading from the boiler, and considerable difficulty is at times experienced in getting the water along them.

It appears to me, that were the dessicating process of Messrs. Davison and Symington used in the drying closet, it would be more efficient in its operation, and save a good deal of time.

I should not, probably, have troubled you with this letter, were it not that the baths in Goulston-square claim to be a model establishment—a sort of pattern to be copied in all subsequent similar erections.

I am, Sir, yours, &c.,
WILLIAM DREDGE.

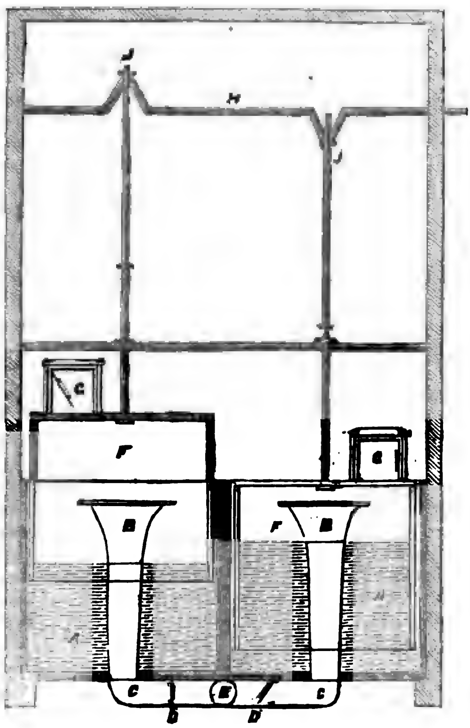
London, 10, Norfolk-street, Strand,
July 4, 1849.

NEWTON'S MINE VENTILATING MACHINE.

Sir,—The following paragraph which has caught my attention in the *Daily News* appears to furnish a good introduction to my present communication :—

"COLLIERY ACCIDENTS.—The numerous accidents which have recently taken place in mines and collieries have induced the Secretary of State to issue instructions to Professor Phillips and J. R. Blackwell, Esq., to inquire into and report upon the state of the collieries and iron-stone mines in the principal coal districts, 'especially with reference to the system of ventilation.' Should this in any case appear defective, these gentlemen are to acquaint the managers, and to suggest such measures as may be requisite to remove the danger; and if such representations are not promptly acted upon, the fact is to be reported to the Secretary of State."

I have now great pleasure in bringing before your notice a description of a simple and cheap ventilating machine, lately invented by Mr. Newton, of the firm of Newton, Smith and Co., the head contractors for the heavy railway works on that part of the Ashford Extension Line lying between Hastings and St. Leonards. Two formidable tunnels occupy nearly the whole of this portion of the line, and the works have suffered considerable interruption from the foul air which prevailed in the headings, one life being lost in consequence, notwithstanding that the usual means were resorted to for keeping the air pure. In order to remedy this serious inconvenience, Mr. Newton proceeded to exercise his ingenuity in the construction of a ventilating engine that should be more efficacious than those hitherto in use. The result of his labours is seen in the accompanying figure, in which A A, are two boxes partially filled with water, each having a funnel, B, penetrating through its bottom, and terminating in a blast-pipe, C; D D, are two valves in the blast-pipe opening outwards, so as to allow of the passage of air from the funnel, through the blast-pipe, and out at E, but preventing the passage of air in a contrary direction. F F, are two boxes smaller than A A, and floating on the water contained in the latter; G G, are two valve boxes, each containing a valve opening inwards, so as to allow air to pass in from the surrounding atmosphere, but suffering none to pass out from the boxes, F F, with which they are in communication, being open at the bottom. H, is a shaft having two cranks, J J, and each working a rod fixed to one of the boxes, F F. The shaft H



being made to revolve, the cranks, J J, by means of the rods, alternately lift and depress the boxes to which they are attached, one being up when the other is down. While one of the F boxes is rising to the top of its course, air is entering through its valve in G, while at the same time the valve D, keeps close. Immediately the F box begins to descend, the valve G is closed by the pressure of air in F, which pressure at the same time opens the valve D', and the air compressed upon the surface of the water in F passes down the funnel B, through C, and out at E. When the box begins to rise the operation previously described takes plase. By this action air is continually being forced down one or the other of the funnels, B B, and thence out at E. Into this latter outlet, a pipe of any convenient length may be inserted for the purpose of conveying air to the locality where it is required. Motion may, of course, be given to the shaft H, by a variety of methods.

The plan accompanying this paper shows what may be called the *double* ventilating engine, as it is optional whether one or two pairs of boxes shall be employed. If only one pair of boxes is employed, a counterbalance is required to assist in drawing the empty box up and regulate its descent. A few days ago I saw a machine of this latter description at work at one of the tunnel shafts on Mr. Newton's contract. The machine was worked by means of a junction between the shaft, H, and the axle of one of the pulley-wheels, over which the rope passed in working the shafts up and down, so that the horse in coiling and uncoiling the rope round the drum worked the ventilator at the same time. The larger box in this case was a yard square, and the lesser one descended through a space not exceeding a foot with the downward stroke of the crank.

Thus each descent of the lesser box sent about 9 cubic feet of air through the funnel. This apparatus cost about 3*l*., and was found to ventilate the shaft and headings far better than the apparatus previously used, which cost 1*l*. a week to work it. Thus the new ventilator has saved its own cost in three weeks, by doing away with the necessity of employing a boy to work it, while, it may be observed, the extra labour to the horse was imperceptible.

There appears a prospect that this simple machine will be employed very generally on the works in the neighbourhood. Mr. Newton freely gives his invention to the public, in the hope that it may be made a general benefit, and help to diminish the frequency of those accidents from foul air with which we are so often horrified. Yours respectfully,

JOSEPH PITTER.

2, Camden Cottages, Hastings, July 6, 1849.

THE BENZOLE LIGHT.—ITS NOVELTY.

Sir,—Mr. Beale is disinclined to controversy, and I hate it; if, therefore, you will kindly insert this reply to his letter at p. 618 in your No. 1351, you need not fear that your columns will be made a field of battle. I am at a loss to conceive what expression in Mr. Macgregor's notice of my invention can have roused a pen which tolerated my own statements in silence. However, in justice both to Mr. Beale and myself, I must answer the remarks which he has been induced to make. For this purpose I have referred to, and carefully read, all the notices which Mr. Beale quotes in support of his positions.

Mr. Beale commenced his critique by expressing his surprise at finding me expatiating eloquently upon a certain invention (which I called an "Isothermal Still Oven") as my "own." Now, before I proceed to answer Mr. Beale's remarks upon this first subject, I have two or three several objections to make to them. The first of these is, that it is not quite fair to include this matter in a letter headed "The Benzole Light.—Claim of Prior Discovery," because it is totally irrelevant to the light in question, and because—supposing the position maintained in that paragraph to be granted—it might have the effect of seeming to throw a doubt on the novelty of the invention to which the next paragraph refers, and which gives the title to the letter. However, perhaps the heading of the letter is not the author's, but possibly editorial, inadvertently prefixed: I don't suppose that Mr. Beale intended any unfair implication.*

2ndly. I do not understand why Mr. Beale, or any other inventor, should experience great surprise at finding an old invention of his own proposed as new at a date subsequent to its publication, especially in a case where the "prior" application is a quarter of a century old, and is not in general use. I consider it as certain, that every invention or discovery revealed through the wit of man, will occur to several different minds; and it is utterly impossible that any one man can have time to learn all that has been invented before him. If we all waited for that, we should cease at once to go ahead,—invention would stop. I should not only not be surprised, but should be glad, to find any other man following the same train of thought with myself, and arriving at the same results.

3rdly. Mr. Beale incorrectly represents the cause of his surprise on this occasion. If he will refer again to the pages of your Journal (No. 1296, page 559), in which you allowed me to describe an "Isothermal Oven," he will not find one syllable about the invention being my "own." I shall be quite as much surprised as Mr. Beale when I find myself "expatiating" on any invention as being my own. I don't believe in inventions of men's "own;" and I do believe "there is nothing new under the sun." I attach not the least value to claims of priority, except where patent right renders it necessary in these days of competition. I have no patent for the "Isothermal Oven," so I should not "claim priority" if the invention were "mine," but should concede the point in silence. However, Mr. Beale attaches some value to it, so I will state the case. I did not borrow that invention from Mr. Beale, or any man. It occurred to me, and I found it practically good. Some months later, a catastrophe happened in St. Paul's Churchyard, which could not have taken place if the means which I knew of had been used, and a repetition of such accidents might be prevented by its adoption.

* Mr. Mansfield is right in his conjecture. The heading was by the Editor.—ED. M. M.

I therefore published it; the light was quite new to several scientific men to whom I represented it, and I believed it to be unpublished. And this is not wonderful; for the book to which Mr. Beale refers me for my extinction, is one of which I never heard before, and which I could not find in the Library of the British Museum without some difficulty. However, on examining the passages referred to, I find that Mr. Beale had availed himself of the very principle which I proposed to apply in the "Isothermal Oven," in a patent granted to him in 1828, as well as in a subsequent patent. But there is some difference in the form of application; the description of the invention in Hebert's "Register" is not very lucid; but I gather from it that it was not contemplated to apply the principle as I proposed. I do not understand from the description there given, that the object of the invention was to maintain an absolutely constant temperature, but to prevent the temperature in certain cases from rising above certain points. It is not stated, in the place referred to, that any temperature whatever, between certain limits, may be maintained constantly; still less is it stated how any exact point may be attained. This, however, I did describe. Further, with such apparatus as is there mentioned (Hebert's "Register," vol. ii., pp. 32, 267), it would be impossible to effect the object of my proposal. Mr. Beale's application was for conditions in which rapid evaporation took place as part of the process to which his method was supplemental, as for steam boilers, &c.; so that the necessary cooling was supplied by the operation itself. My suggestion was for the general purpose of keeping any substance or apparatus at any temperature. However, I concede to Mr. Beale all "priority" and credit for this application, and hope no one will ever rob him of his due, to assign to me a share of commodities which I repudiate.

The case, however, is different with the next paragraph of Mr. Beale's letter, that about the benzole light. For this I have obtained a patent, and its originality and novelty I must maintain so long as I have faith in it. I do not mean to say that the benzole light is absolutely new, for I think it very possible that Noah's Ark was lighted by it. But I assert that in this generation my method of applying the air-light is new—in the sense of being hitherto unpublished, undescribed, unknown—(most likely not unimagined) and that it was so far original with me that I owe neither the notion nor any of the details of its perfection to any man: and that it is essentially different from any invention that has been brought before the public, although two or three bear a superficial resemblance to it. Before, however, replying to Mr. Beale's attack on my property (the patent, not the invention), I must notice his preliminary remarks. He says, that in a paper of mine, read to the Institution of Civil Engineers, April 17, 1849, I objected to his light, insinuated that it was a failure, and that I had made improvements thereon. All this Mr. Beale denies: so do I. There are four mistakes in these premises. I did not object to his light; I insinuated nothing about its qualities. I did not state or insinuate that it was a failure; and I did not state that I had made improvements on his invention. I could not object to his light, for I have never seen it; and my belief, from what I have heard and read of it, is that it was very beautiful, and very ingenious. I stated in plain English, without insinuations, why I believed it had not been introduced into practice, viz., because of the complexity of the burners, each of which was an entire lamp and reservoir. I stated—not that the lamps or the principle of the light was a failure (for I am certain they must have answered, and would answer their purpose perfectly)—but I stated that their introduction was a failure, and so it is; for the lamps are not in public use, though ample time for their introduction has elapsed. Lastly; not only did I not say that I had improved on his inventions, but I stated that I had never heard of them till after my own was perfected; and I endeavoured to show that there was an essential difference between them. I believed that I had done Mr. Beale justice; and all I can say is, that if he will call on me, I will show him my light, when the difference between it and those described in his specifications, will at once be obvious to him; and will show him also the MS. of the paper read to the Institution of Civil Engineers, to which I will add, when it is printed for publication, any note which

he may conceive necessary to render perfect justice to himself. I will now parry Mr. Beale's thrust at the validity of my patent. I am perfectly aware that Mr. Faraday discovered benzole, so is every one who is versed in chemistry (though Mr. Faraday did not procure benzole from coal tar); and more than that, benzole had been found in coal tar several years ago; I believe, however, that it is not on record that any one ever attempted to show, before the enrolment of my specification, that benzole existed in large quantity in coal tar, or how it could be extracted. I stated that the problem of naphthalizing common air, so as to make it luminiferous, had been solved by the appearance of this volatile hydrocarbon in large quantities, not by its discovery. I do not the least doubt that Mr. Beale used benzole for his air-light; but I am quite certain of this, that he could not have used benzole for this purpose to any practical extent; first, because the only source of this substance known at the period of his experiments was the manufacture of oil gas, in which only a very small quantity was produced; secondly, because if Mr. Beale had got hold of such a useful material he would not have let it drop.

I can only answer Mr. Beale's reference to the specifications of his patents, by repeating the reference; for I am certain that any reasonable man who will compare the popular descriptions of the two inventions, or the specifications, or the actual apparatus used by Mr. Beale and by myself, will at once see that they are quite distinct. I carefully read over Mr. Beale's specifications before I drew up my own, and I worded my descriptions and my "claims" so as to disclaim all the ground occupied by his light. In the paper to which allusion has been made, I pointed out exactly wherein my method differed from his. I will do so briefly again. In Mr. Beale's patent two lamps are described, which come near mine, being air and naphtha lamps; in one of these a surface of naphtha is kindled in a vessel, and a blowpipe-blast of air is driven through the flame; in the other the air is passed through the hydrocarbon in a vessel, and thence passes, charged with vapour, to the burner; but the burner must be close to the reservoir, which "requires to be kept at a heat of about 120° Fahr." by a small lamp placed beneath it. A few words quoted from the notice of his invention in the numbers of your Magazine, to which he refers, will show the principle of his "lamps:" "The mixture of oxygen and vapour takes place in the burner, which also answers the purpose of a retort." Again: "... the object being, whatever be the shape given to the burner, to supply a regular sufficiency of heat to the upper part of the fluid in the cup." The combustion is "adjusted by raising the burner from the fluid." "The hydrocarbons are contained in a reservoir connected with the burner." Now the very principle of my invention is, that the reservoir of light fuel is entirely separated from the burner—may be in the cellar, or perhaps a mile off—and, by service pipes, may supply any number of burners — simple burners, not lamps; and the evaporating liquid need not be so hot as the human hand. Benzole will answer this purpose; common coal naphtha will not; nor is any hydrocarbon made in practicable quantity, except benzole from coal naphtha, which will fulfil these conditions.

I trust, Sir, I have proved that Mr. Beale has not yet shown that I have "been anticipated in every particular." I do no doubt that f Mr. Beale will take the trouble to examine the matter, he will find, and will declare that I am not infringing his patent, but have worked on ground which he left unoccupied. I do not the least doubt that Mr. Beale's lamp will yield as good a light as my benzole system, with a cheaper fuel; but then his apparatus is much more expensive, each burner being a somewhat complex lamp.

In conclusion, I must add that the only sentiment for which I find ground in meeting with a successful labourer at work before me in the same field, is one of fraternity—not of jealousy.

I am, Sir, yours, &c.,
C. B. Mansfield.

P. S.—Perhaps you will allow me to take this opportunity of stating that I have "claimed" the use of "chromic acid and its salts" for the purification of naphtha, under my patent dated Nov. 11, 1847, which I see by your p. 620, is "claimed" anew by Mr. Wildsmith, under a later patent.

MR. MOAT'S PATENT IMPROVEMENTS IN PISTONS AND STUFFING-BOXES.

[Patent dated January 4, 1849. Patentee, William Crofton Moat, of Upper Berkeley-street, Middlesex, surgeon. Specification enrolled July 4, 1849.

Fig. 3.

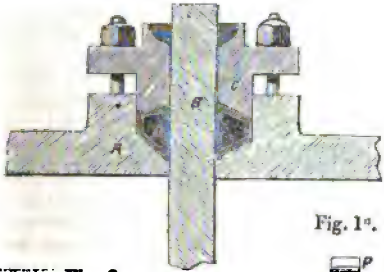


Fig. 5.

Fig. 4.

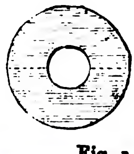


Fig. 1a.

Fig. 2.

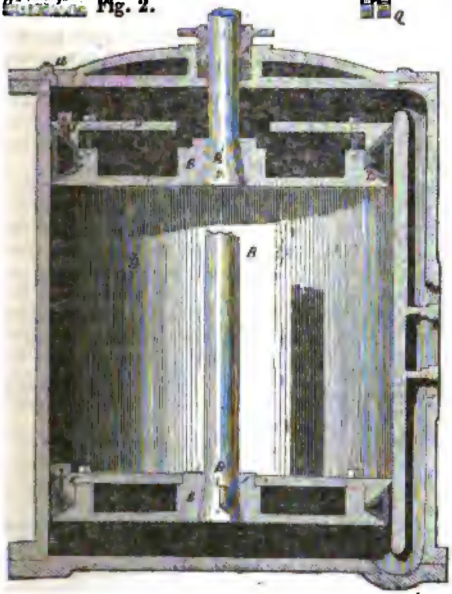
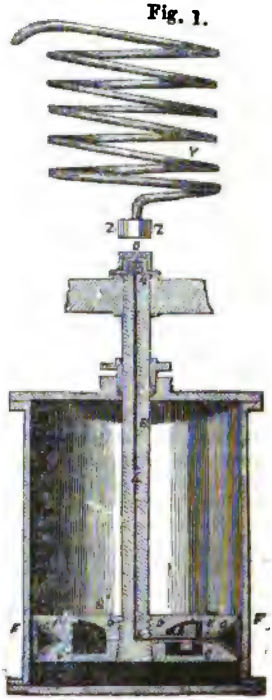


Fig. 1.



Mr. Moat states that his invention has for its object "to construct the pistons and stuffing-boxes of engines worked by steam, air or gas, in such manner, or with such appliances that they shall fit more exactly, and be less subject to change of form and consequent leakage than heretofore. The manner in which he effects this is novel and ingenious. His description of it is as follows :—

Fig. 1 is a sectional elevation of so much of a steam engine as is necessary to show how I propose to effect the better fitting or packing of pistons. A A is the cylinder with its covers and stuffing-box, B; the piston-rod, F, a solid metal ring, which is turned to fit the inside of the cylinder, and forms the exterior of the piston, B^1; C is the lower plate of the piston; D, the central portion of the upper plate, or as it is commonly called, the "junk ring;" and E the outer or periphral portion of the latter; G is a hollow ring, which is made of some soft or yielding material, as lead or vulcanized caoutchouc, and fits into a recess made for it in the body of the piston, and abuts outwardly against the metal ring, F. The ring is in its original state of a circular form, but when pressed into the recess, it takes the triangular shape, or nearly so, represented in the engraving. L is a passage

which is bored down through the centre of the piston rod, and terminates in another passage, L^1, which diverges from it at a right angle, and is connected by a union joint, I, to a third pipe, J, which leads into the heart of the hollow-ring, G; M is a valve-box, which covers in the passage L, at top; P, a piece of cork, with a crutch or stool Q, (see detached view of these parts in fig. 1^a,) which fits into M; O, a cap to M; Y is a coil of tubing (of indefinite length) which is attached when required, by union joints, Z Z, to the top of the valve-box, M, at one end, and at the other to an air-forcing pump placed by the side of the engine, or in any other convenient position. The use of the hollow yielding-ring, G, is to keep the metal ring, E, pressed out against the sides of the cylinder, and this is effected by charging it at intervals with air from the pump, and to any amount of pressure which may be found requisite. When the ring is to be charged, the cap O, of the valve-box, M, is removed, and the coil of pipe, Y, attached by the joints, Z Z, to the valve-box, M, at one end, and to the pump at the other. The requisite injection of air is effected by working the air-pump, and the degree of pressure produced on the interior of the hollow ring is indicated by a pressure gauge. When the ring has been pressed tightly against the cylinder sides, the pressure should be reduced about one-half by unscrewing the top of the valve box, until the gauge indicates that the desired degree of reduction has been obtained (which the coils in the pipe allow of being done without disturbance to the union joints). The top of the valve box should then be rescrewed down tight against its seat, the pipe Y removed, and the cap O, put on to prevent any air escaping past the valve.

The arrangements which have been thus described will, it is obvious, answer equally well, whether the ring in immediate contact with the cylinder sides is solid, as represented in the engraving, or split, or composed of a number of segments.

It will be obvious also, that instead of forcing in the air through a passage bored in the piston-rod, it may be introduced through a pipe passed down through the cylinder alongside the piston-rod into the body of the piston, and which pipe may be either rigid or flexible. Or, the air may be injected directly into the piston by introducing a hand-condensing syringe, through a door in the cylinder cover, and inserting the nozzle of it into an opening in the body of the piston. An arrangement suitable to both these plans is represented in fig. 2. A, is the cylinder, and *a*, a door in the cylinder cover for the introduction of the pipe or syringe, as the case may be; B, the piston; D, the upper plate or junk ring; G, the hollow yielding ring, and E, the opening in the piston, which, in the case of the hand syringe being used, should be covered by a valve of the same kind as that before described as being used for covering the passage in the body of the piston rod.

Again; instead of a constant command being maintained by the means aforesaid, over the pressure, so that it may be supplied only when wanted, and to the exact amount wanted, the hollow ring, G, may be charged in the first instance, with compressed air to such an extent in excess of the average pressure required, as to obviate any necessity for renewal, in which case the air pump and air passages, and their respective appendages, would be dispensed with. But as such an arrangement would leave the engineer without any ready means of assuring himself of the soundness of the piston, or of repairing it in the possible event of damage from violence, I do not consider it as preferable, or equal to the mode of packing before described.

The objections to the preceding arrangement do not, however, apply to the stuffing boxes of cylinder covers, especially in the case of engines worked at a low pressure; and with respect to these, therefore, I do recommend the employment (in place of the ordinary modes of packing) of air-tight hollow rings, of some yielding substance, charged at once with compressed air to such an extent, that this air shall have a constant tendency to press them outwards on all sides.

A mode of charging a piston different from that before described is shown in fig. 2. B^1 is a section of a piston in a partially finished state; and B^2, a section of it as ready for working. The hollow yielding ring, G, is dropped loosely into a place made for it between the under and upper plates of the piston, and close to their respective peripheries; and the plates are then drawn together by means of the screw bolts, *d d*, until the ring, G, is compressed into a much smaller space than it originally occupied, and the air within it is also proportionably compressed.

Fig. 3 is a sectional elevation of a piston-rod and stuffing-box packed in the same manner as just described in its complete state. A is the cylinder cover; B, the piston-rod: C, the stuffing-box; and G, the yielding hollow ring. Fig. 4 is a plan of the ring, G. Sometimes I make this hollow ring in the semicircles or other sections of a circle, as indicated by the dotted lines in fig. 4.

Instead of employing yielding hollow

rings applied in a horizontal position to pack pistons and stuffing-boxes, as before described, I sometimes effect the same object by means of short lengths of tubing of lead or other yielding material applied spirally, in the manner exemplified at A^8, in fig. 2, which is a section of a stuffing-box on this plan. The pipe is first tapered off and closed at the two ends, as shown in fig. 5, and then coiled round the piston-rod, with the bottom end resting on the under plate of the stuffing-box. The upper plate is then screwed down upon the pipe till it is not only pressed out at both sides (that is, against the piston at one side, and the cylinder cover at the other), but is altogether compressed into a much narrower space than it originally occupied, accompanied with a corresponding compression of the air in the inside of it.

And having now described the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim as my invention is the employment of yielding hollow rings and yielding tubing, of whatever material the same may be composed, filled with air, more or less compressed, for the better packing of the pistons and stuffing-boxes of engines worked by steam, air, or gas, as before exemplified and described.

ON THE FLAMBING OF SHIPS BOWS.—IN ANSWER TO "B. J.'S" STRICTURES ON "F.'S" LETTER IN THE "MECH. MAG.," NO. 1349. (SEE "MECH. MAG.," NO. 1352.)

Mr. Editor,—Allow me to thank "B. J." for the good spirit which pervades his strictures.*

"B. J.'s" strictures are, however, to my mind, without point, since the disparity which may obtain between the weight of displacement of the foremost section and the weight of hull and lading of that section, is quite beside the argument, since this disparity is compensated for by the less weight and greater displacement of other of the foremost sections: the starting point of each of my positions is from the horizontal or load water-line, at which position the compensation alluded to has been made in either vessel.

Two vessels of equal displacement are moving with equal velocity in a horizontal direction, neither having longitudinal motion till they meet a wave at the same time and under similar circumstances, except that of a difference in their form.

One has the form of G above the water-line at the section *a* in A, which is considerably greater than that of *b* in B; consequently, on their meeting the wave, A is subject to a disturbing force greater than that of B, in proportion as the displacement of the section before *a* in A is greater than that before *b* in B; therefore the rise of A and shocks which A will be subject to, will be greater than those which B will be subject to; and so also when they arrive at a hollow between the waves, as the displacement below the water-line, and before *a* in A, is greater than that below the water-line, and before *b* in B, a greater amount of displacement will be lost by A in passing into the hollow than by B; therefore A will be subject to larger disturbing force, and will fall further than B, and necessarily so.

"B. J." admits that A will not rise higher, but for the same reason it will fall lower, for he admits that it will lose more buoyancy than B by the passage of the wave behind. His argument with reference to the water embracing the bow in A earlier than in B does not apply till she has fallen below the hollow (there being no water in the hollow to embrace the bow), and till she have fallen sufficiently to compensate for the greater loss of buoyancy she sustained by the passage of the wave behind, and if the greater moment of motion of A's greater weight of hull and lading, and in that section of the bow, did not carry the bow further down, the shock which she would sustain from the increased resistance which the water would offer to prevent it, must be very injurious to the strength of the fabric and to her speed.

I must repeat that a flambing bow can only increase the evil it was intended to correct, or, at least, to lessen. Then, with reference to the guns and lading of our men-of-war their weight is much over-rated; thus, the total weights of the following vessels, including their masts, &c., are—

* There is an obvious mistake in the last line, left hand column, page 567, where sterns should be read stems.

	Weight of Hull.	Total Weight of Guns and Lading.	Separate Weight of Armament.
Constance	1477 tons.	1090 tons.	260 tons.
Barham	1447 "	1090 "	260 "
Pique	1180 "	678 "	184 "
Castor	940 "	703 "	170 "
St. Vincent	2400 "	2230 "	320 "

Under-rating the weight of hull has led to many failures in our men-of-war, and an exaggerated estimate of the difficulty of providing for the *great* weight of guns is frequently given to account for failures, but which it may be seen is quite too small to justify any.

I have no doubt but that "B. J." will perceive on reflection, that the increased weight of hull which a flambing bow necessarily entails is an unmixed evil, and cannot be adopted without a violation of true principles.

I am, Sir, yours, &c.,

F——.

MR. BISHOPP'S "DISC" ENGINE IMPROVED.

We were betrayed last week by the language of the article upon this engine, which we quoted from the *Times*, into a very considerable error respecting it. The article was headed in the original "Rotary Engines," and it spoke of Mr. Bishopp's engine throughout as being of the "rotary" class. We, too, fell naturally into the mistake of so regarding it, having but a vague recollection of the "Disc" engine in its original state, and suspecting nothing less than that Mr. Bishopp (from whom the *Times* must be supposed to have derived its information) should not know the name of his own adopted child. We have been since informed that it is not a rotary engine at all; and on referring to the enrolled specification of Messrs. Davies and Taylor (Oct. 26, 1836) we find this to be true. Curiously enough, however, even in that specification it is called a "rotary engine," and this in the face of some pains taken to show that "the piston does *not* actually revolve," and is PREVENTED (by a partition) from revolving. After all, therefore, Mr. Bishopp has but adopted along with the child, a name foolishly given to it by its own parents.

The motion of the "Disc" engine, though not rotary, can hardly be called reciprocating; it is in fact, neither the one nor the other in the sense in which these words are ordinarily understood, but a something compounded of both. Messrs. Davies and Taylor in their specification call in the Sun and Earth to help them to explain what this complex movement is; but with very indifferent success. We have some hope of being able in a future article, with the aid of a little geometrical analysis, to convey to our readers a somewhat clearer idea of the path it describes, than the inventors have been able to do themselves; but it is one of those things which to be readily and fully comprehended must be seen.

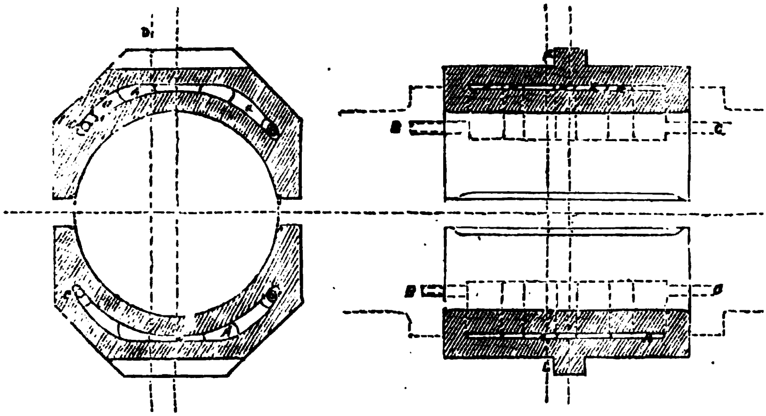
We have ourselves had the advantage since last week of such an occular inspection of this engine at the *Times* Office, and very cordially bear our humble testimony to the highly efficient manner in which it does all the work of that vast establishment. Occupying, as it does, but a small corner in an immense hall (though of full 16 horses power)—giving motion by a single index finger (as it were) to the new and huge machinery of Applegath, by which more than 10,000 copies an hour are printed of a journal which, confessedly, more than any other, leads, and guides, and governs the world—it looked to us, in fancy, liker the fulcrum which Archimedes imagined and sighed for, than anything else we had ever seen.

In the future article before promised, we shall explain in what Mr. Bishopp's improvements consist; but it is no more than right that we should state at once that we think they fully account for that which was once so "decided a failure" being now so eminently successful.

Several other engines of this "Disc-improved" kind have been mentioned to us as having been for a considerable time at work. At the paper works of Messrs. Dickinson and Co. there are four; one of 30 horses power, two of sixteen horses power, and one of 8 horses power; at the starch-works of Messrs. O. Jones and Co., Battersea, one of 30 horses power; and at the paper-works of Mr. Brock, Dover, one of 16 horses power.

BRUNET'S REFRIGERATING BRASSES.

[Registered under the Act for the Protection of Articles of Utility. James Joseph Brunet, of the Canal Works, Limehouse, Civil Engineer, Inventor and Proprietor.]



The object of the invention which forms the subject of this registration is, to obviate a great and acknowledged evil, namely, the heating to which the brass journals or bearings of the plummer blocks of railway shafts, the brass joints of connecting rods, &c., are now subject—involving, as such heating does, the rapid wear of the parts, and the consequent derangement of the machinery dependent on the exactness of their action, for its efficiency.

Mr. Brunet proposes to make a cavity in each pair of brasses, and to cause, by means of two pipes—an inlet and an outlet one—a stream of cold water to flow continually through the cavity. Of the perfect sufficiency of this remedy there can be no doubt.

The engraving shows a pair of ordinary brasses on this plan adapted for a plummer block bearing, or for the joint of a connecting rod.

A A is the cavity; B is the inlet pipe; and C the outlet pipe. The brasses are strengthened by pillars, *a a*.

In the case of brasses for the joints of connecting rods, and other similar parts of machinery in motion, the pipes or tubes must be flexible, in order to follow the motion of the rod.

COURT OF QUEEN'S BENCH, WESTMINSTER.—JUNE 30.

[*Sittings at Nisi Prius, before Lord Chief Justice Denman, and Special Juries.*]

HOLLIDAY *v.* FAWCETT.—BOTH OF HUDDERSFIELD.

Mr. Webster and Mr. Pollock appeared for the plaintiff, and Mr. Hayes for the defendant.

This was an action to try the validity of a patent taken out by the plaintiff for improvements in Self-Generating Gas Lamps, which it was alleged the defendant had infringed. From the evidence it appeared that though several patents had been taken out for portable lamps, to burn gaseous or spirituous liquids without the use of wicks, none of them had succeeded in that object, so as to bring them into extensive use, until the improvements introduced by the plaintiff had removed the former defects; and that since those improvements had been effected the sale had been very great: and the utility of the new lamp was so manifest that many parties had commenced to make them without due license from the patentee, and, amongst the foremost, the defendant, whose son had been in plaintiff's employ, during the time that the models of the different kinds of burners patented had been made for the purpose of being set forth in the specification.

Counsel in setting forth plaintiff's case, stated that the action was brought to assert the right of plaintiff, and not with a view of obtaining damages. The defence was that the patented improvements were not new; and in support of this plea, evidence was adduced to show that a burner for a vapour lamp, similar to that claimed by plaintiff, had been sold and invoiced to a party in the month of November, 1847, being nearly two months prior to the sealing of the patent. On examination, however, in Court, the burner proved to be essentially different.

An attempt was made by defendant to show that he was not the party that sold the particular lamp upon which the action was brought, but that the lamp business was his son's, though conducted in his (defendant's) shop. This portion of the defence, however, signally failed, for it was proved that the defendant was present when the lamp was sold, and the invoice was made out in his name, and receipted by defendant also.

The Judge, after commenting on the evidence, told the jury that if they thought the invention of the plaintiff superior to others, it was sufficient to establish his exclusive right to make and vend the same, and he accordingly left it to the jury to say,

first, whether the defendant sold the lamp upon which the action had been brought, and, second, whether the invention was new?

The jury retired; and on returning to Court, gave a verdict for the plaintiff, on both the points left to them by the judge. The Judge's Associate, on receiving the verdict, stated to the jury, that having found in favour of the plaintiff's right, it would only be necessary to specify a nominal sum, as the plaintiff had not made it a question of damages. The jury, therefore, found damages one farthing. The judge, upon being applied to, certified for costs, which the defendant will accordingly have to pay on both sides.—*Birmingham Journal, July 9th*, 1849.

MAGNETIC ORE SEPARATOR.—AN AMERICAN COPY OF AN ENGLISH ORIGINAL.

Sir,—In your valuable periodical for June 10, 1843, you have favoured me, under the title of *Mullins's White Lead, &c.*, with a review of a patent of mine, dated October 1842, and in your last Number, July 7, you give an account of an apparatus patented in America by Ransom Cook, Esq.

In principle, and in effect, you will see that my patent is the same. The apparatus I put up is constructed with magnets obtained by galvanic action, and, excepting in mechanical arrangement, Mr. Cook's is similar to mine. After describing my apparatus and illustrating it with drawings, you will see that the claim set up by me is for "*the application of magnets to separate iron from the oxide of lead, or of other metals, and to separate iron.*" The oxides are discharged down a shoot, fixed at an angle of about 30°, formed of wood or some other non-conducting material, from the bottom of which the poles of a number of magnets project upwards, and to which a slow lateral, sieve-like motion is given by machinery; the magnets attract and retain the iron, and the oxides pass free.

Your faithful servant,

JOHN MULLINS.

Battersea, July 9, 1849.

[We have verified Mr. Mullins's references, and find that his statement is quite correct. ED. M. M.]

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 12TH OF JULY, 1849.

JOHN COOPE HADDAN, 29, Bloomsbury-square, C. E. *For an improvement or improvements in railway wheels.* Patent dated January 5, 1849.

This invention consists—

1. In making the spokes of wrought iron bars, which have their nave ends bent into the form of three sides of an equilateral polygon, so that they may overlap one another. These ends may be placed radially or tangentially to the centre, and welded to one or between two cheeks, and are cut away from the centre hole of the cheek, so as not to come in contact with the axle. These spokes may either be of the L, Δ, or T form, and are bent into the desired shape at the nave end by means of suitably shaped blocks.

2. The tyre of the wheel is made of less diameter at the part next to the flange than in the centre, in order that the tread may be on the centre of the line of rails.

3. To enable the flanged wheel to run on tramways, a ring with a plain periphery and a portion of its inside circumference chalked down to receive the flange, is shrunk on.

Claim. The three several modes of constructing railway wheels.

WILLIAM ROWE, New Wharf, Whitefriars, London, carpenter and joiner. *For certain improvements in the mode of uniting or combining pipes or lengths of pipes, tubes, or channels formed of glass, earthenware, or other similar material.* Patent dated January 11, 1849.

The pipes are constructed near their points of junction with inside or outside grooves or projections, and are united by means of metal clips or clasps furnished with corresponding grooves or projections. Rings of some suitable elastic material are interposed between the points of contact of the tubes, to allow of their being brought close together. Or, in order to dispense with the use of the elastic rings, the external diameters of the ends of some of the tubes are made smaller than the ends of the others, in order that they may fit into one another, and are furnished with ears whereby they are bolted together.

Claims.—The uniting of pipes,

1. By means of grooves on their exterior circumferences and indented metal clips, in combination with elastic rings.

2. By means of projections on their exterior circumferences and extended metal clips, in combination with elastic rings.

3. By means of projections on their internal diameters and metal clasps, in combination with elastic rings.

4. By means of the peculiar construction which allows of the use of the elastic rings being dispensed with; and,

5. Permits of their being bolted together.

OBED BLAKE, of the Thames Plate Glass Company, 13, Southampton-street, Strand, gentleman. *For certain improvements in ventilating, or ventilators for or in ships, vehicles, houses, or other buildings.* Patent dated January 11, 1849.

The improvements in ventilating are as follows:—

1. Slips of glass are fixed transversely, and at suitable distances apart, in a window frame, behind which is placed another, but

moveable frame, furnished in a similar manner with transverse pieces of glass, so that as it is lowered or raised, the glass strips of the moveable frame may be brought over the spaces in the window frame, so as to prevent the ingress of air into the apartment, or *vice versâ*. The moveable frame is moved up and down by the action of a wedge-shaped piece of wood placed beneath, and which is slidden to the right hand or to the left by means of a stud passing through a slot in the fixed frame. The moveable frame is kept down by two springs placed above it, and the bottom of the wedge-shaped piece is fitted with wheels to enable it to run more smoothly in the frame.

2. The style of the window frame is perforated with several holes covered with wire gauze, and behind them is a moveable plate, also perforated with similar holes at a like distance apart, and covered with wire gauze, which, as it is slid backwards or forwards, opens or closes communication between the interior and outside of the apartment.

3. Doors are pierced with holes in that part which is to be covered with finger plates, which are made with corresponding holes covered with wire gauze, and are provided with a sliding piece to admit or prevent the ingress of air to the apartment.

4. The windows are composed of stout pieces of crown or flint glass cut in a diamond shape, which are supported at their ends in a vertical system of levers or "lazy tongs." The ends of the tongs are brought nearer to, or farther from each other, by the action of a right and left-hand screw passing through them, whereby they will be elongated or shortened, and the pieces of glass consequently separated from each other, so as to leave a space between for the passage of air, or brought into immediate contact with one another, so as to cut off the passage. Or the pieces of glass may each be fitted with a pin that takes into a slot in a sliding vertical flat rod, which as it is moved up or down, will admit or prevent the ingress of air.

5. To ventilate ships, holes are cut in their sides, and fitted with iron telescopic cylinders. The inside cylinder in each case is constructed with openings, furnished with slides, so that as it is thrust outwards or drawn inwards, air will or will not be admitted. The slides are for the purpose of regulating the quantity so admitted.

6. The patentee remarks that the air in immediate contact with the glass shades of railway carriage and other roof of lamps, becomes necessarily vitiated by the radiation of heat, and he proposes to convey it outside by enveloping the glass shade in a second one open at bottom and communicating at top with the external atmosphere.

The patentee claims the various arrangements and combinations as indicated in the drawings which accompany the specification, when applied to ventilating purposes.

WILLIAM WALKER, Manchester, agent. *For certain improvements in machinery or apparatus for cleaning roads or ways, which improvements are also applicable to other similar purposes.* Patent dated January 11, 1849.

The present invention consists in effect of a new street-sweeping machine, which runs on four wheels, and supports in front, on either side, two channel brushes, and behind them a large transverse diagonal brush, which is driven from one of the locomotive wheels (the two channel brushes being driven from the other one) by means of suitable toothed gearing. When in action, one of the channel brushes is withdrawn from contact with the ground, while the other sweeps the soil from the sides in front of the large roller brush, which sweeps it in turn into a ridge following the line of road. The larger roller may be made to incline diagonally in either direction by means of a bar moving in a slotted quadrant; and the channel brush, which is farthest from its edge, is the one that must be withdrawn from contact with the ground. The channel brushes are rendered expanding by having the bars which carry them connected by levers to rings passing over right and left-handed screws.

When the soil has been swept into a ridge, it is gathered up by a machine, which consists of a frame running on wheels that give motion to two wheels supported in it, which are placed one beneath the other, and round which passes an endless chain of buckets. The bottom of the frame is curved, into which the buckets successively take, and is opened behind just above the curve, and fitted with a sloping board up which the soil is swept by a small roller brush, driven by the locomotive wheels, into the curve, whence it is taken by the buckets and emptied through a conducting pipe into a cart temporarily attached to the machine.

An improved cart is lastly described, which may be used as a soil cart, liquid manure distributor, fire-engine, or watercart, and consists of a case running on wheels, having a sliding top, and capable of being tilted over by means of a toothed segment, pinion, and hand-winch connected to it. When required, it may be fitted with a water-distributor, or with a rotary pump inside and a liquid manure distributor.

Claims.—1. The general construction and arrangement of the machinery for sweeping the soil into ridges, particularly the construction and application of the channel brushes, the mode of expanding them, and

the means of changing the position of the diagonal brush.

2. The general construction and arrangement for cleaning the ground, raising the soil and depositing it in a cart, detached from, and independent of the machine. Also the construction of cart and the application of rotary pumps thereto, and the mode of tilting the same.

MICHAEL LOAM, Treskerley, Cornwall, engineer. *For improvements in the manufacture of fusees.* Patent dated January 11, 1849.

A strip of calico, or other suitable elastic fabric, is led from a reel underneath a hopper filled with gunpowder, and is caused to assume the shape of a trough, which, when supplied with the necessary quantity of gunpowder, is drawn under weighted projecting pieces, and through a hollow axis, which have the effect of bending the edges of the calico over so as to complete the tube. Upon this axis is a collar, which supports a rotary plate, and carries an adjustable sliding piece through which the tube is led. The rotary plate is furnished with a convenient number of bobbins having yarns or threads wound upon them. The sliding plate is perforated with holes, and the threads are passed through them and attached to the tube. The plate and bobbins are made to revolve, and the tube drawn out, whereby the threads or yarns are wound round it. The tube, as it is drawn out, is wound upon a drum. Instead of threads or yarns, it is proposed to use a tape. When the tube has been thus far completed, it is coated with some waterproofing material, as usual.

Claim.—Manufacturing fusees for mining and other purposes by means of calico, or other suitable flexible fabric or material, which is progressively made to assume the form of the internal tube.

FRANCIS HOBLER, Bucklersbury, London, gentleman. *For improvements in the construction of the cylinders or barrels of capstans and windlasses.* Patent dated January 11, 1849.

Mr. Hobler's invention consists in constructing the barrels or cylinders of capstans and windlasses with curved grooves of sufficient size to suit the links, in order to give increased hold or bite to the chains. The surfaces of the cylinders may be partially or wholly of metal.

Claim.—Constructing the barrels or cylinders of capstans or windlasses with curved grooves, as described.

WILLIAM EDWARD NEWTON, Chancery-lane, C. E. *For a certain improvement or improvements in the construction of wheels.* (A communication.) Patent dated January 11, 1849.

A new railway wheel is here presented to our notice, which is composed of three portions—the nave, the rim, and two side plates. The rim is of cast iron or wrought iron, with the exterior circumference chilled, or of steel, and has two dovetailed grooves cut in the edges of its interior circumference. The two side plates are of sheet iron convexed outwardly, and have their circumference turned to fit into the dovetail grooves respectively. The rim is expanded by heat, to allow the side plates to take into the grooves, and afterwards shrunk on. The side plates are attached together by screw bolts near the nave, or screw-nut and collar, and will have the effect, on account of their convexity, when screwed up closer to one another, of forcing the edge of the plates into closer contact with the rim. Or, the side plates may be bolted to the rim. The side plates may be plain or corrugated.

Claim.—Forming a wheel of three principal parts—a rim piece, and nave with two side plates, made with plain or corrugated surfaces, and formed more or less convex outwardly; the whole constructed, put together, fastened, and having tightening pieces as described, whether the principal parts are put together by means of dovetailing the side plates into the rim piece; or, if the rim is attached by means of screw bolts or rivets passing through the plates near the rim; and whether the plates are tightened upon the rim by means of screw bolts placed near the axle, or having a screw-nut and collar upon the axle, or by any analogous means by which the outward convexity of the plates may be forced inwards or towards each other at or near the centre, thereby causing their peripheries to expand, stretch, and enlarge into full contact with the rim.

MILES WRIGLEY, Ashton-under-Lyne, architect. *For certain improvements in the manufacture of yeast or barm.* Patent dated January 11, 1849.

The patentee proposes to manufacture liquid yeast or barm by mixing 100 lbs. of brewers' barm or yeast with 100 lbs. of distillers' barm or yeast. He then mixes separately 1 lb. of flour with 4 oz. of spirits of wine, and 10 oz. of water, so as to form a paste, which is afterwards mixed with the brewers and distillers' yeast or barm. In order to produce solid yeast or barm, the mixture is placed in linen bags and subjected to pressure in hydraulic or other presses, whereby the liquid is expressed, and the remaining solid portion is preserved for use.

Or, instead of the substances before mentioned, sesqui-carbonate of ammonia, tartaric acid, carbonate of soda, &c., may be used.

Claims.—1. The mode of manufacturing

yeast or barm in a liquid or solid state by the admixture of the substances before described.

2. The application of hydraulic and other presses to separate the liquid from the solid yeast.

Christopher Nickels, Albany-road, Surrey, gentleman. *For improvements in preparing and manufacturing India-rubber (caoutchouc.)* Patent dated Jan. 11, 1849.

These improvements refer to the construction of the masticating machine and to the vulcanization of caoutchouc.

The masticating machine consists of a case open at top, but capable of being closed at pleasure, in which revolves the kneading roller, fitted with flanches at each end, to prevent the caoutchouc under operation from coming into contact with the ends of the cylinder; and the roller is in some cases made to work eccentrically in the cylinder. Heat is communicated by means of a steam jacket.

The powder or flowers of sulphur is mixed with the caoutchouc while in the masticating machine, and heated to a low temperature, in the proportion of one to six, after which it is pressed into blocks in heated moulds, and may then be cut into sheets or thread. The blocks are, however, first put under a weighted board, to which a to-and-fro movement is imparted, in order that the vulcanized caoutchouc may be subjected to pressure and to a vibratory motion, which, the patentee states, produces a beneficial effect upon it. Fumes of sulphur may be substituted for the powder or flowers, and it is proposed to pass hydrogen or phosphorus to the caoutchouc during the masticating process.

Claims.—1. Making the cylinders of the masticating machines with flanches, and to work eccentrically in the cylinder.

2. Manufacturing India rubber by combining it with sulphur or substances containing sulphur, or the products of sulphur, by kneading, grinding, or masticating it. Also by combining it with the fumes of sulphur during the kneading, grinding, or masticating process. And, lastly, by combining it, when mixed with sulphur, with phosphorus.

James Castley, of Harpenden, Hertford, manufacturing chemist. *For improvements in the manufacture of varnishes from resinous substances.* Patent dated January 11, 1849.

This invention consists,

1. In manufacturing in manner following, from resin spirit and the gum resin called gutta percha or gutta tuban, a new compound or varnish, which possesses the properties of being strongly adhesive and perfectly water repellent. The patentee puts into a pot three parts, by weight, of the gutta percha or gutta tuban, as imported or as it may be bought in the home market, and adds nine parts of crude rosin spirit (obtained by the destructive distillation of common rosin), and subject them to a heat of from 120° to 140° Fahrenheit, stirring the mixture occasionally. The resulting solution forms a varnish which answers well for the coating of all coarse fabrics, such as tarpaulings, rick-cloths, &c.; but to obtain a varnish of a purer and better quality, suitable for fine articles, he substitutes in the preceding process for the crude rosin spirit, a rectified rosin spirit, which he obtains by passing a current of steam through the crude rosin spirit until the condensed product which comes over exhibits a specific gravity of about 0·870, at which point the process of distillation must be stopped, all products of a higher specific gravity being injurious to the quality of the spirit.

2. The invention consists in manufacturing a colourless varnish, in manner following, from gum damar and rosin spirit, or from gum mastic and rosin spirit. He first takes rosin spirit which has been rectified by steam, as before described, and mixes with it from one-tenth to one-sixth its weight of sulphuric acid, of not less specific gravity than 1·700, and agitates the mixture well, after which he rectifies the spirit over again by means of a current of steam, as before, when the spirit comes over in a colourless state; and, finally, dissolves the gum damar or gum mastic in about four times its weight of this purified rectified spirit with the aid of a gentle heat. A varnish of an inferior sort may be obtained by using rosin spirit which has undergone one process of rectification only, and not been treated with the sulphuric acid.

Claims.—1. The manufacture of the new varnish compounded of gutta percha and rosin spirit (crude, rectified, or purified), as before described.

2. The manufacture of the new varnishes compounded of gum damar and rosin spirit, or of gum mastic and rosin spirit, whether such spirit is rectified and decolourized or rectified only, as before described.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal for May*, 1849.]

For an Improvement in Cane Umbrellas. *Isaac Hammond.*

Claim.—"What I claim as my invention is, the connecting of the rod with the socket-piece, and with the cap, by means of spring catches, which are received within grooves that extend around the interior of the said socket-piece and cap, in the manner and for the purposes set forth."

For an Improvement in Machinery for Making Bullets. *J. Drummond.*

The patentee says,—"The nature of the *first* part of my invention consists in making bullets from flat plates of lead, cast, rolled, hammered, or otherwise formed, of a thickness less, and of a width greater, than the intended diameter of the bullets to be formed, when this is to be combined with the process of making such bullets, by cutting the lead for each bullet, by a punch and die, from the width of the bar, by means of which combined process or mode of procedure, the bullets are cut off and formed without leaving scraps of lead in the operation of cutting, as heretofore, thus saving the labour required in recasting the scraps, and forming them into a bar. And the *second* part of my invention relates to the machine for cutting off the pieces from the bar and forming the bullets, and consists in using a punch, the end of which is formed with a semi-spherical cavity, combined with a die having a cylindrical cavity for the punch to move in, the bottom of which is in the form of a semi-spherical cavity, with a small hole in the centre thereof, to which is adapted a sliding follower, one end of which constitutes a portion of the semi-spherical cavity of the die, the said follower being so connected with the punch, that when it (the punch) is drawn back, it shall carry the follower with it sufficiently far to discharge the formed bullets, and then permit the punch to move back, independently of the follower, to leave the required distance between them to receive the bar of lead, which is of greater width than the diameter of the bullet when formed."

Claim.—"What I claim as my invention, is the method set forth of forming bullets, by cutting at each operation a piece across the width of a bar of lead made thinner and wider than the diameter of the intended bullet, that the punch, in the operation of cutting, may force the said piece of lead into the die, and there swage it into the required form, and thus avoid leaving remnants, as described."

WEEKLY LIST OF NEW ENGLISH PATENTS.

Richard Garrett, of Leiston Works, Suffolk, agricultural implement maker, for improvements in horse-hoes, pugmills, drilling and thrashing machinery, and in steam engines and boilers for agricultural purposes. July 7; six months.

Edward Ives Fuller, of Margaret-street, Cavendish-square, carriage builder, and George Tabernacle, of Mount-row, Westminster-road, coach iron founder, for certain improvements in metallic springs for carriages. July 7; six months.

Thomas Sedgwick Summers, of Cornwall-terrace, Lee, Kent, lighterman, for certain improvements in fastenings for mouths of sacks and bags. July 9; six months.

William Laurie, of Carlton-place, Glasgow, merchant, for improvements in means or apparatus to be employed for the preservation of life and property, such improvements, or parts thereof, being applicable to various articles of furniture, dress, and travelling apparatus. July 9; six months.

John Goodier, of Mode Wheel Mills, near Manchester, miller, for certain improvements in mills for grinding wheat and other grain. July 9; six months.

George Augustus Robinson, of Long Melford, Suffolk, gentleman, and Richard Egan Lee, of Glasgow, gentleman, for certain improvements in the manufacture of bread, and in the machinery and apparatus to be used therein; and also improvements in the regulation of ovens and furnaces, part of which improvements are also applicable to other similar useful purposes. July 10; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses	Subjects of Design.
July 5	1944	Charles Hart	Wantage, Berks	Plough-head.
"	1945	Thomas Evans	24, Southampton-street, Strand,	Fastening for collars, stocks, shirts, and fronts.
6	1946	J. Davies and Charles Maltley	King's Head-court, Holborn; Wood-street, Gray's Inn-road,	Rotary self-acting tobacco-pipe machine.
"	1947	William Geose	Birmingham	Self-feeding apparatus for nail machine.
"	1948	John Smith	Corven, near Wolverhampton	Feeding apparatus for mills.
"	1949	Edward Burgess	16, St. John-street-road, Clerkenwell	Fire indicator and alarm.
7	1950	George Harborow	Holborn-bars	Shirt collar.
"	1951	Insole, Jones, & Kimberley	Birmingham	Harness back-band tag.
9	1952	Francis Edward Colegrave	Brunswick-terrace, Brighton	Constables' staff.
"	1953	John Whitehead	Preston, agricultural machine maker	Tile machine expander.
10	1954	John Jones	Duke-street, Liverpool	Tailors' symetrometer.
11	1955	Thomas Allen	Radcliff, Lancashire	Twine box.

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NOTICES TO CORRESPONDENTS.

"A. Z." and "Vindicator," in our next.

CONTENTS OF THIS NUMBER.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1354.] SATURDAY, JULY 21, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

URWIN'S PATENT STEAM ENGINE IMPROVEMENTS.

Fig. 13.

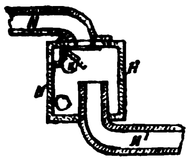


Fig. 11.

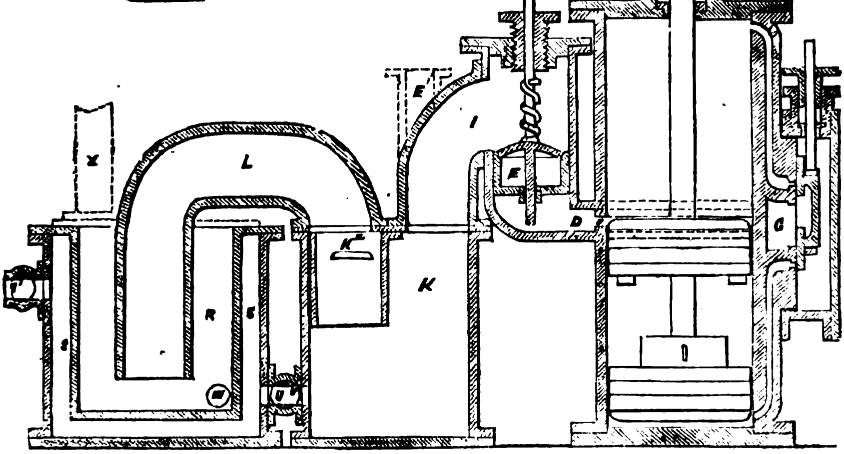
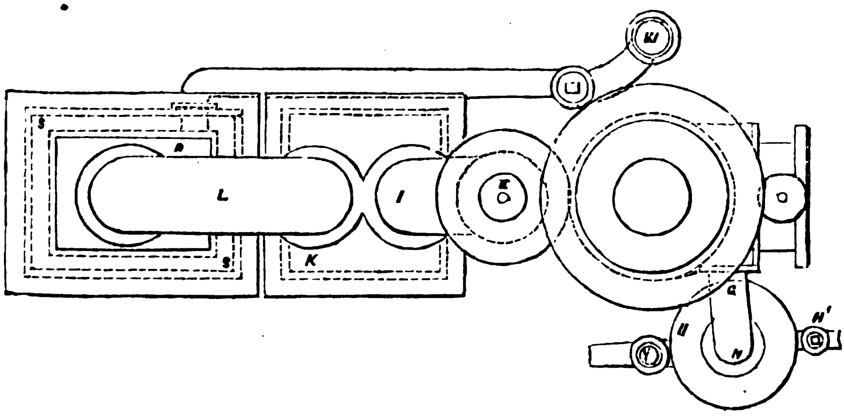


Fig. 12.



URWIN'S PATENT STEAM-ENGINE IMPROVEMENTS.—(CONTINUED FROM P. 29.)

Second Branch.

"*Secondly*, my invention has for its object to reduce the consumption of fuel in marine and stationary engines, and also to obviate the rapid wear of tube and boiler surfaces arising from the employment of impure or salt water, and the deposits and incrustations resulting therefrom; and I accomplish this by providing the boilers with a supply of warm distilled water in the manner exemplified in figs. 11 and 12. Fig. 11 is a vertical section of one of a pair of marine engines, with the additional apparatus necessary for carrying this part of my invention into effect; and fig. 12 is a plan of the same. The engine is represented as being of the improved kind before described, but I desire it may be understood that I do not limit myself to the use of any particular sort of engine in combination with the system of condensation and distillation, which I am now about to describe. C is the middle opening in the cylinder through which the great bulk of the steam is, as before explained, discharged at each stroke of the piston into the jacket or casing, D, and valve-box, E. I is a pipe by which the steam is conveyed from the valve-box, E, into a covered cistern, K, which is kept about half-filled with cold water, and where the steam being of high pressure (say, as before, 50 lbs. or 60 lbs. per square inch) and consequently of a temperature much higher than the boiling point of water, converts a considerable portion of the cold water with which it comes in contact into vapour. K^a is a shield for breaking the force of the steam as it rushes into the cistern, K. L is a bent pipe by which the steam and vapour in K are carried over into a condensing vessel, R, which is set in a casing, S, filled with cold water, and closed in at top from the atmosphere. I^1 is a pipe by which the casing, S, obtains its supply of cold water from the river or sea, outside of the vessel; and U, another pipe with cock, *v*, attached to it, by which the first cistern, K, is fed from the casing, S, as required. The condensed water which collects in R is transferred, while still in a warm state, by a pump, V, and connecting-pipe, W, to the boiler. Any steam or vapour which may happen occasionally to remain uncondensed at the top of the receiver, R, is let off into the atmosphere by a pipe, X. By the preceding arrangement, all the steam which passes through the cylinder, with the exception of the small residual portion which goes off through the exhaust passages, GG, to the condenser, H, (as explained under the first head of this specification) is in effect worked over and over again, and any short-coming in quantity which may arise from imperfect condensation or leakage is more than made up for, by the portion of the cold water in K, which is evaporated by coming in contact with the high-pressure steam, and which, of necessity, must pass off in a fresh state, whether the water is fresh or salt. The water of condensation, too, is constantly supplied in a warm state to the boiler, requiring but little additional heat to raise it to a state of ebullition. The salt or other impurities which are precipitated to the bottom of the cistern, K, are drawn off from time to time through a flush trap door (not seen in the engravings).

"The small condenser, H, which serves in this, as in the locomotive engine before described, to complete the exhaustion of the steam cylinder after the escape of the bulk of the steam through the middle opening, C, is represented separately in fig. 13. H is the condenser; N, the common receiving pipe, into which the exhaust passages, G G, empty themselves; H^1, a pipe, by which water is allowed to flow from the outside of the ship into the condenser, H; Y, a pump, by which the water in the condenser, when it becomes heated, is pumped overboard; and Z, a float-valve attached to the condenser end of the pipe, N, by which, on the engine being stopped, any upflow of cold water through that pipe into the cylinders is prevented.

"As the supply of steam from the condensing apparatus will always be more than sufficient for the wants of the boiler, a portion of it may be led off through a pipe, E^1, attached to the valve-box, E, into the chimney, in order to accelerate the draught of the furnace or furnaces, the pipe, E^1, being provided with a cock by which it may be shut or opened at pleasure."

Mr. Urwin's patent embraces also the

application of the principle of exhaustion adopted in his steam-engine, to pumps, and other hydraulic instruments.

Some illustrations of this application we shall give in our next.

MULTIPLICATION.

Sir,—The investigation of the rule for squaring numbers, published in No. 1351, led me to the following method of multiplication; but as it requires nearly double the number of figures to be written than the usual method does, it may be necessary to say something in its defence.

Multiply 5674 by 9.

```
57|64
9
------
45 63
 5 436
------
51 066
------
```

Multiply 7463 by 3508.

```
76|43
35 08
-----
21 18
 1 209
 3 530
   2015
   0
    0
    5648
     8224
---------
26 180204
---------
```

Multiply 92043 by 567.

```
903|24
567
-------
450 015
 10 29
 54 0018
  1 224
  6 30021
     1428
---------
521 88381
---------
```

Multiply 89756438 by 79.

```
8763|9548
79
-----------
5649 4221
 638 52856
 726 35427
  81 458672
-----------
7090 758602
-----------
```

Multiply 867509 by 354718.

```
870|659
354 718
-------
242 100
 18 1527
 40 3500
  3 02545
  3 22900
    242016
    564900
      423563
      080700
        060509
        645600
          484072
--------------
307 721057462
--------------
```

All persons accustomed to computation are so familiar with the multiplication table up to 10 times 10, that they never err in stating the product of two digits, yet in the multiplication of larger numbers errors are not uncommon; this must arise from the complex process of multiplying two digits and adding the tens of the last product, which is not only the source of error, but as the result is not perceived instantly, some time is lost at every step, so that numbers may be multiplied by the present method, notwithstanding the increased number of figures, with as much rapidity as by the old one, and with incomparably less liability to error.

Rule.—Write down the 1st, 3rd, 5th, &c., figures of the multiplicand, and then the 2nd, 4th, 6th, &c., separated by

some mark; multiply the odd figures by the highest figure in the multiplier, writing the products separately from left to right, making each product to consist of two places, by prefixing ciphers, if necessary; do the same with the even figures of the multiplicand, writing the products in another line one place to the right. Continue the same process with the remaining figures of the multiplier, placing the successive odd and even products, one place to the right of the last product of the same name, it will be soon seen that they form pairs, which should be the guide in practice.

The reason of the rule is very simple; it is obvious that if we combine every separate figure in the multiplier with every separate figure in the multiplicand, and add all the products, properly arranged in the decimal scale, we shall have the product of the two numbers. I give a simple and uniform method of obtaining the partial products in their proper places.

W. O.

Islington.

DAVIES'S ROTARY ENGINE.

Sir,—Mr. Dredge says (p. 541, last vol.), that my assumption that each piston subtends an arc of 60° on both sides of the line of cylinders, is unwarranted by anything I have heard or read in reference to the engine in question. I can only say, in reply, that my knowledge of the engine is derived principally from what he has stated on the subject, and that he stated in one of his earlier letters that such was the case, without intimating that there was any difference between the single and the double-acting engines in this respect. I therefore submit that the assumption was not unwarranted. Nor does a reference to the specification bear out his statement that all the ports are open for the admission of steam four times in each revolution, during the time that the piston is passing through an arc of 30°. The specification says nothing directly upon the point; but in the diagram which represents the method of setting out the cam by which the slides are worked, the cam occupies 90°; so that, even in this case, it may be said *all* the passages would be closed four times in each revolution, although I admit it would be but for an instant.

But, not to insist further upon disputed points, I would notice some undeniable characteristics of the engine, by which it is most advantageously distinguished from most of its predecessors. First, is the *necessity* of employing *two cylinders*, or a fly-wheel, to produce a rotary motion; and secondly, the motion of the pistons *in vacuo* through a considerable portion of their course, whereby the size of the cylinders requires to be enlarged, without producing any useful effect, and the action of the steam is rendered abrupt and desultory.

Considering these defects, and in the absence of any countervailing advantages, I must confess that I am at a loss to account for the encomiums passed upon the engine. The mere working of the engine for sixteen months proves nothing; for—as I stated in my first letter—many rotary engines (which I named) have been at work for a much longer period, and are still at work.

I am, Sir, yours, &c.,

A. Z.

July 10.

[Having communicated the preceding note to Mr. Dredge, with the view of shortening, if possible, the discussion, he has favoured us with the following:—]

Sir,—"A. Z." finds "*his demonstration*" erroneous, and exclaims "I have been led into the error by Mr. Dredge himself;" yet, with his usual consistency, in a subsequent paragraph he alludes to a certain diagram *which was published in the Mechanics' Magazine some months since*, and which, he says, "he had not previously attended to." I can well imagine *that*, but had he even now attended to it, some of the errors in his last letter might have been avoided; for he would have seen that the diagram alluded to, illustrates, the geometrical projection of the curve of the pistons; and a slight acquaintance with geometry would have taught him that the same principle of projection may be applied to a piston subtending an arc of 120° as to one of 50°. His observations, therefore, in reference to the measurements taken from this diagram fall to the ground.

I am, Sir, yours, &c.,

WILLIAM DREDGE.

London, 10, Norfolk-street, Strand,
July 17, 1849.

ON FLAMBING THE BOWS OF SHIPS.—"B. I." IN REPLY TO "F."

Sir,—I was obliged to object to "F.'s" omitting duly to consider in his letter the influence which the weights in the bow exert on the pitching motion. So long as these were considered beyond the question, "F." was right to diminish the displacement forward, both with the view of diminishing the amount of disturbance caused by the passage of the wave, as also to lessen the shocks of waves breaking on the bow.

"F." believes the want of buoyancy; to which I did allude, "*compensated by the less weight and larger displacement of other of the foremost sections;*" this, I must confess, is contrary to my conceptions. I would ask, if this compensation be also there, if we leave the midships empty, and remove all the weights to the extremities? If not, these sections must always be behind the deficient one, and consequently increase the leverage, on which the unsupported weights in the bow act.

A large wave meeting the bow, and rolling from stem to stern, will lift successively the fore-body, in points before, or very close to the centre of gravity of displacement of the fore-body. In the form where this centre is nearer to the centre of gravity of the whole displacement, a greater force is necessary, in order to lift or support the deficient sections forward, and therefore a greater resistance is created, because the wave, in order to exert this force, must embrace the fore-body at a point nearer to the deck; and when the crest of the wave arrives a little abaft the common centre of gravity, the falling moments, which are as the square of the distance from the centre of oscillation, will be much larger in the bow B, on account of this their greater leverage.

There are objections to both forms; the question remains doubtful which is attended with the fewest evils? Whether a greater angle of oscillation, but a slower, more floating motion, and the more violent shocks of the waves, in the round-bowed form, is a greater evil than the more sudden plungings, and very often entire burial of the sharp, yet heavy, bow in the waves, together with the constant strain on the structure (even in a state of rest), the effects of which are very conspicuous in the concavity of the under side of the keel—to the greatest extent in men-of-war, where this disproportionate arrangement of the weights is almost necessary?

"F." supposes the two vessels under similar circumstances. Then, this arrangement of the weights will also be the same in both; and A will, in the section he points out, have no "*greater weight of lading*" than B, it being impossible in men-of-war of equal displacement, and different forms, to diminish these weights, or alter their distance from the stem, as we diminish the displacement forward. And the increased weight of hull, (within practicable limits,) I must repeat, is slight in comparison with the buoyancy a full fore-body entails; the increased weight of hull being only as the increased breadth of the decks, and the increase of displacement as the cube of the breadth.

Neither is it only with regard to the armament that I must object to this alteration of the form. A sharper fore-body is believed to carry the centre of effort of the sails more forward; consequently, the foremast will require to be moved nearer to the stem in the less buoyant bow, and, therefore, still more increase the falling momenta.

I believe with "F." that the flambing form is contrary to true principles; but are we not forced always to violate true principles in naval science, where so many opposite qualities are necessary, and only a mean between them can be reached and wished for?

I am, Sir, yours, &c.,

B. I.

THE SHIP-BUILDERS AND THE ENGINEERS—CASE OF THE "RETRIBUTION."

Mr. Editor,—It is high time that the public should be undeceived as to the value of the excuses offered for the many failures in the ship-building department of the Navy. My Lord of Portland says, speaking from authority, that it was intended the *Retribution* should have 500 horse-power engines; but that the engine makers having represented that they could put engines of 800 horse-power into the space intended for the former, which should be of only the same weight—they were allowed, on the faith of this statement, to put the latter in; but that on doing so, it was found that they were larger and heavier by

100 tons, in consequence of which mistake of the engineers, the ship was a failure.

It does not seem to have occurred to any party, that an 800-horse engine would require more coal than a 500, as no provision seems to have been made for the difference. I will grant that there were enough coals for the 800-horse engine, though I do not think so, and make a present of that portion of the argument, and proceed to show that this mistake, supposing it to have been made, was wholly insufficient to account for the defects in that ship; and I think it scarcely fair of his Lordship to lay the blame elsewhere than where it rightly attaches, namely, to the late surveyor and his assistants; for though his Lordship says that he speaks on authority, till he gives up that authority, the injustice must attach to him.

I need not tell you, Sir, that the engines must have been put together in the factory when the mistakes as to size and weight were discovered, if not before, and communicated to the builder, who himself, or by his assistant, should have ascertained whether these were so great as to cause a failure, and if so, they ought to have prevented the engines from being put in.

The following arguments will prove to the lowest comprehension, that her deficient stability could not have been caused by the mistake alluded to, and that the whole of the errors which have produced the unhappy result called the *Retribution*. must be laid at the door of the constructive department of the Navy.

If we assume, what was most probable, that the centres of gravity of the intended 500 and 800-horse engines were equally high, then we have only the extra 100 tons of weight to deal with, as respects stability, which, having its centre at the centre of gravity of the engine, and much below the centre of gravity of the ship, would have increased rather than decreased the stability, so that this solution of the difficulty would tell the other way.

However, lest we should be said to exaggerate, we will grant, that the height of the centres of gravity of these engines differed in the amount usual in engines of similar construction, but differed in power as the $\sqrt{}$ of the ratio of their respective powers, $\sqrt{5}$ to $\sqrt{8}$, and let it be assumed that the centre of gravity of the 500-horse engine was intended to have been 10 feet high, this would place it about 8 feet below the centre of gravity of the ship and lading (without the engine and boilers). The weight of these engines would then have been about 340 tons, and the ship's displacement about 2660 tons—from which we have, as the effect on the common centre of gravity of the system, by placing the 500-horse engines as above stated, $340 \times 8 = 2720 \div 2660 = 1 \cdot \frac{2}{10}$ feet, the quantity which the centre of gravity would have been lowered, and the stability proportionally increased.

Following our assumption, the centre of gravity of the 800-horse engine would have been 12·6, or 5·4 feet below the centre of gravity; and with 100 tons more in weight, we have $440 \times 5{\cdot}4 = 2376 \div 2660 = {\cdot}89$ feet, the quantity which the common centre of gravity would have been lowered by the 800-horse engine; that is to say, the centre of gravity was lowered less in the amount of one-tenth of a foot by the 800-horse engines than it would have been had those of 500 been put in; from which it would *appear* that the original design would have had a very slight amount more stability than that which obtains in the *Retribution*. I use the expressive *appear* advisedly; for, no doubt, the greater immersion in the latter case, will have given a larger area of load water-line, by which the metacentre would be raised; in other words, the stability would be increased, so that, on the whole, there would not have been less stability in the existing ship, than in that originally designed.

Yet, we may grant him the full value of this one-tenth; for she would have been a failure irrespective of this alteration which produced it, supposing it to have been injurious, for she would have been so if she could not have carried 300 tons of coals, or other weights, upon her upper deck, without its materially injuring her properties (a quantity which some of our steamers have carried). Her upper deck is about 15 feet above the centre of gravity, from which we have as the effect on the centre of gravity $300 \times 15 = 4500 \div 3000 = 1\frac{5}{10}$ feet; the quantity which the new centre of gravity would be raised to, by placing 300 tons 15 feet above the previous centre—or, in other words, the amount of altera-

tion in the position of her centre of gravity, which no extraordinary duty would entail on her; and she would have been a failure if her form and arrangements were such as to incapacitate her from the performance of such duties, without material injury to her properties, *showing that a mistake* 12 *times greater than that which the engineers are said to have made*, would scarcely account for her present deficiency in stability. We are told that she is to have 400-horse engines put into her, and thus, if great care and judgment be used, we shall have an indifferent transport for 120,000*l.* or 130,000*l.*!

I am, Sir, yours, &c.,

F——.

DR. HAWORTH'S RESPIRATORY APPARATUS.*

We willingly lend our aid to bring under general notice a small pamphlet which has been sent to us from Bolton, in which the author—Dr. Haworth, of that place—describes a respiratory apparatus of his own contrivance, and treats at large of the means proper to be used under every variety of circumstances, for purifying the air we breathe. It abounds in shrewd remarks and sagacious advice, and will well repay a perusal.

The author opens his treatise by observing that, "at a time when so much attention is given to the subject of pure air and ventilation, it is a matter of surprise that no plan has been proposed to purify air, under certain circumstances, *immediately before it enters the lungs*;" but so far as the matter of novelty goes, Dr. Haworth afterwards acknowledges that he is somewhat in error.

This apparatus resembles, or rather, I may say, is identical with, the Turkish hookah; and it is strange that such a simple means of cooling and mollifying the smoke of tobacco should not have suggested a similar means of purifying and cooling air, previous to inspiration, in other cases. Since my attention has been given to this subject, I have found that Dr. McCormac, of Belfast, from a hint derived from Mr. Dredge, C. E., has suggested, in a communication to the *Mechanics' Magazine* of May, 1848, a system of ventilation on the hookah principle, on a large scale. His suggestion was, that air should be passed by some mechanical means, through a certain depth of water on its passage to a room or building.

The following is the description of Dr. Haworth's own apparatus; it is illustrated with an engraving, but will be sufficiently intelligible without it.

I propose the following method of acting upon that portion of the air only which is inspired. The apparatus consists of a cylindrical vessel, through an air-tight cover of which are passed two tubes, also fixed air-tight. One of these tubes just enters the vessel and no more, the other descends to the bottom, and terminates in a flattish circular box, closed on all sides, with the exception that the upper side is perforated with a number of small holes, and on the under side there is one larger hole for the purpose of emptying the box when requisite. Into the cylindrical vessel is introduced water, or a solution of a chemical agent, in sufficient quantity to rise more or less above the perforated box. If we apply the mouth to the short tube, and make an effort to inspire or draw in air, the air will descend the long tube, and, passing in minute division through the perforations, will rise in bubbles through the liquid, and be exposed to its action before entering the lungs. Expiration, or discharge *from* the lungs, is of course made into the open air. In this manner the breathing is carried on through the apparatus. The facility of breathing will be more or less, according to the height the liquid rises above the perforated box: when this has been an inch I have breathed through the apparatus a quarter of an hour with very little inconvenience, and could have continued any reasonable length of time. I was able to withdraw my attention from my breathing and the apparatus, and attend to other matters. An increase of the depth of the liquid does not increase the difficulty of breathing to a proportionate extent. I have tried an inch and a half and two inches without any great inconvenience. Some persons will possess naturally greater power than others, and practice will, no doubt, increase them.

* * * *

The long tube, with its terminating perforated box, is best made in one piece of glazed earthenware, that it may resist the action of chemical agents. I have had some made by Alcock and Co., Hill Pottery, Burslem, of the following dimensions:—

* Description of a Portable Respiratory Apparatus for Protection in Cases of Fire, Infected Air, Choke Damp, &c. By Thomas Haworth, M.D. 16 pp. 12mo. Bradbury, Bolton.

length of tube, 8 inches; diameter of ditto, half an inch; diameter of circular box, 4½ inches; depth of circular box, ⅝-inch; holes in upper surface, about fifty in number, in diameter about one-tenth or one-sixteenth of an inch; one hole in the under surface, in diameter one-sixth of an inch. The cylindrical vessel may be made of copper, tin, gutta percha, glass, or earthenware, according to the properties of the chemical agent employed. The cover may be of cork, with two perforations for the two tubes, or it may be of the same material as the vessel itself. In the former case, the short tube may be of glass; in the latter, of the same material as the case itself, and soldered to it. In either case, a piece of vulcanized India-rubber tube, of convenient length, may be attached to the short tube, and terminate in a mouth-piece. For facility of breathing, it is of consequence that the tubes should be of good width. A strip of moistened bladder, wrapped round the junction of the cover with the vessel, will make it air-tight.

The size of the cylindrical vessel will vary according to the height of the fluid above the perforated box, and according to its viscidity, with a view to provide plenty of bubble room. When the fluid is viscid, the bubbles are persistent, and, after a few inspirations, occupy a large space; though this may be advantageous in causing a longer contact between the air and the solution, it incurs the necessity of a larger vessel. The whole apparatus may be conveniently suspended from the shoulders, and both hands left at liberty. It is not necessary that the vessel should be cylindrical; it may be of a concavo-convex shape, so as to apply itself to the side without being cumbersome.

The author then explains, under different sections, the use of the apparatus—to save persons from suffocation on occasion of fires — to remove poisonous gases from the air—to purify a pestilential atmosphere—to remove carbonic acid from the air—and to neutralize the influence of acid and poisonous fumes in chemical manufactures; illustrating each branch of the subject as he proceeds, by notices of such remedial means as have been proposed by others, and by familiar expositions of the scientific principles bearing on the matter in hand. We quote, as a sample of the instructive and useful information which the pamphlet contains, the section of which carbonic acid is the theme:—

Use of the apparatus in removing carbonic acid gas from the air.—This apparatus may be applied to the purpose of removing carbonic acid gas from air, when it is necessary to breathe such a mixture. I have made many experiments to ascertain to what extent this poisonous gas may be absorbed by this means. The vessel was filled with a solution containing 25 per cent. of caustic soda, till it reached an inch above the perforated box. After the mixed airs had been exposed to this solution by forcing them through the perforations in the box, I found that more than half of the carbonic acid was removed. I varied the proportion of the gas from one-half to 1·20th. The same experiment did not always afford the same result, because the air could not always be forced through the solution with the same rapidity, and the size of the bubbles would also vary. I may mention that I endeavoured to effect the passage of the air through the apparatus with the same rapidity as in breathing.

If it be true that we can thus deprive air of one-half of its carbonic acid, we become able to breathe an atmosphere which would be otherwise poisonous. Suppose it to be a matter of importance to enter a locality, the atmosphere of which contains 10 per cent. of carbonic acid, a proportion which would soon produce insensibility, by breathing through this apparatus the quantity of carbonic acid would be reduced to 5 per cent.—a proportion which might, I think, be respired for a considerable time, without much inconvenience.

It is a common opinion that the burning of a candle in a suspected mixture of carbonic acid and air is a satisfactory proof that it may be respired with safety; but Dr. Taylor in his manual of "Medical Jurisprudence," has shown this to be erroneous. He found, by experiment, "That a candle will burn in air which is combined with ten, or twelve and a half per cent. of its volume of carbonic acid; and although such mixtures might not prove immediately fatal to man, yet they would soon give rise to giddiness, insensibility, and ultimately death." But if the burning of a candle, in a mixture of carbonic acid and air, is not of itself a sufficient indication that air is respirable, yet its combination with the purifying apparatus would be useful in this way, that wherever the candle continued to burn we might infer that the quantity of carbonic acid was not so great, but that the apparatus would remove so much as to make the air respirable for a considerable length of time. Under ordinary circumstances, the lighted candle would prove not only that the carbonic acid was limited at most to 10 or 12

which bears upon the magnets be 3 cwt., and the magnets to have a sustaining power of 2 cwt., action and re-action being equal, I ask what would be the impinging power exerted by the borer upon the opposing rock, when in operation?—for certainly this is a projectile, and must be calculated accordingly.

Suppose the battery to reverse its polarity 10 times a second, and the magnets to separate only the thousandth part of an inch at each pulsation (the clearing of the hole by the recently invented method of pumping water down being approved of), the progress will be found to be three feet per hour.

I do not calculate on receiving any benefit whatever from the attractive principle of the magnets; but I receive in full the whole amount of their repulsive energy. The weight which loads the magnets being superior to the sustaining power, the stroke can never have an ascending tendency; the boring machinery must sink while the battery on the surface is in operation, and the weight which loads the magnets follows the descending borer by its own gravity. In boring from the surface, the battery remains above, and the wires connect with the magnet, however deep the workings may be, the points being shielded from danger of soiling by a simple sheath. As the borer will remain constantly at the bottom of the hole, there will be no power lost, as in the other methods, by the displacement of the loose matter at every stroke of the cutter.

Not being a practical miner, although I have investigated the theory somewhat, I would leave the form of the cutting tool to those better versed with that subject, remarking that, in cutting hard rock, a single chisel would get wedged in; but by using two common magnets, with a chisel to each —a positive end of the one magnet, and a negative of the other, being presented to each end of the one electro-magnet,—they would work alternately, and at every reversal of polarity; producing a double effect, and freeing each other's chisel at every stroke.

This electro-magnetic method of boring admits of being carried to any depth, as the magnets descending with the chisels carry with them the same amount of energy as when at the surface, and as the sustaining power of the electro-magnet may be increased many fold above the example I have instanced, it leaves no doubt in my mind but that a powerful agent is here presented to the mining interest of the country.

Regarding lateral borings, it is only necessary to use pressure on the magnets, instead of the heavy weight with which I have illustrated my description, and the mode in which it will be applied will depend on the nature of the work to be executed. From the friable nature of coal, I should say that this machine might be introduced into the mining of that mineral with certain success, as an auxiliary to the men, in the manner of a pioneer, in cutting always in advance of the workers, leaving them merely the work of pulling down the walls which it has bored into and undermined.

I have been as concise as possible, but I hope sufficiently clear to convey an idea of the principle. I have never attempted it in operation, but recommend and leave it to any party who may feel interested. I believe the idea to be new and good, and take this method to throw it to the world, for others to improve.—*Franklin Journal.*

ON THE COMPARATIVE VELOCITY OF LIGHT AND HEAVY BODIES FLOATING DOWN RIVERS.

Sir,—With regard to the phenomenon of light and heavy bodies floating in running water, adverted to in page 580, *Mech. Mag.*, vol. l. (from an unpublished letter of the late Sir Samuel Bentham), may I take the liberty of pointing the attention of your scientific correspondents to this interesting subject. I confess I entertain considerable doubt, whether the explanation popularly given in the extract, is at all sufficient to account for the phenomenon, or whether, upon investigation, any analogy will be found to exist between the circumstances of a body floating in running water and descending an inclined plane. Of the *fact* stated, namely, that of the heavy body having acquired a greater velocity than the light one, each being subject to the free influence of the stream, there cannot be a doubt after the palpable instance recorded; but it is highly probable that the cause of this strange effect rests upon other grounds than those assigned, and that the relative velocities are governed by laws in no way connected with the motion of bodies down inclined planes.

I am, Sir, yours, &c.,

S.

July 10, 1849.

DESCRIPTION OF AN ATMOSPHERIC GUN CARRIAGE, INVENTED BY H. D. P. CUNNINGHAM, ESQ., R.N.

The principle of this plan of gun carriage is, *that the force which drives the*

gun back in the recoil is collected, and applied to run the gun out again. The gun is thus, in fact, made to work itself; a few men only being required for training and loading.

This is effected in the following manner:—

AA (fig. 1) is a slide on which the carriage, BB, works. In this slide is fitted a tube, CC′, having therein a piston and piston-rod, to the end of which the carriage is attached by a screw collar at D. This tube is open at the inner end, C, and at the other end, C′, is furnished with a valve or lock opened or shut by the handle, F. The piston being supposed to be at the bottom of the tube and the valve, F, closed, (the gun, of course, being now run out) it will be seen that when the gun recoils, it carries the piston with it, and a vacuum is thereby produced at the outer or valve-end of the tube, which creates an amount of atmospheric pressure on the inner side of the piston, regulated by the diameter thereof, equal to the force of recoil, and which pressure will of course drive the gun out again.

Fig. 1.

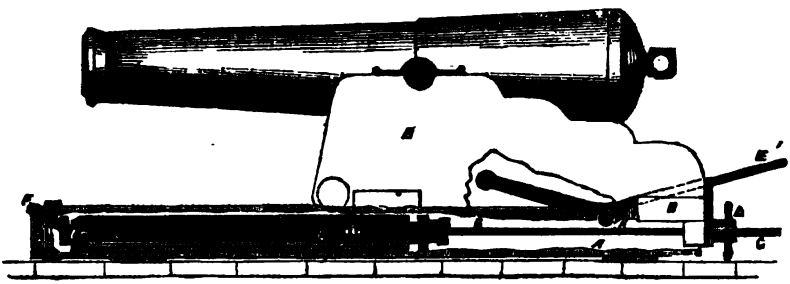
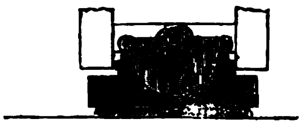


Fig. 2.



In the case of guns loading at the breach, no further application is necessary; but where guns are loaded at the muzzle, in the ordinary manner, it is necessary to detain the gun from running out until the operation of loading be completed. This is effected by a lever, EE′, attached to the inner part of the carriage, and which is furnished with a gab or notch, which falls over the stop-bolt or paul at K, and thus secures the gun until loaded; when on lifting the end of the lever at E′, the carriage is released and driven out by atmospheric pressure as before described.

Should the gun be to leeward, and it be desirable to reduce the force for running out, and the resistance to the gun coming in, by allowing a small quantity of air to enter the tube, the purity of the vacuum will be partially destroyed, and the column of air admitted will form a resistance to the piston when it arrives at the bottom of the tube.

The screw collar at D is for the purpose of connection, and also for easing the gun in in extreme training. On the carriage being disconnected at D, or by opening the valve, F, the gun can be worked in the ordinary manner.

Fig. 2 represents an end view of the carriage and slide.

Besides the advantages which this plan offers for working heavy guns with very few men—thus enabling merchant vessels to provide themselves with heavier and more effective armaments—it is contemplated that the reception of the shock of explosion on the elastic nature of the vacuum, or its counter force, will prove very beneficial to the ship's side, and be a subject for special consideration.

per cent., but that oxygen was not materially deficient. I do not forget that Dr. Taylor has shown that a candle will burn in a mixture of 25 parts of oxygen and 75 parts of carbonic acid; but such a mixture is artificial and not likely to occur in nature.

We are thus furnished with a means of exploring coal mines where choke damp prevails. As carbonic acid gas is very generally the result of combustion, and formed at the expense of the oxygen of the air, it is of the greatest consequence that the apparatus should be accompanied by a lighted candle, the degree of brilliancy of which may indicate that there is a sufficient quantity of oxygen. What amount of oxygen is necessary to maintain life in a human being I do not know; but I understand that Dr. Boswell Reid concludes, from some experiments which he has made, that if the carbonic acid be removed as fast as it is formed, an animal may remain in a limited quantity of air without much inconvenience, until nearly the whole of its oxygen is exhausted. The experiments of Dr. Snow, however, do not warrant the above conclusion. He found that birds and mammalia introduced into an atmosphere containing only 10 to 10½ per cent. of oxygen, instead of 21 per cent., soon died, though means were adopted for removing the carbonic acid formed by the respiration. He is of opinion that any notable diminution of oxygen, even when no carbonic acid is present, cannot take place without danger to the warm-blooded animals.

Dr. Reid, in his work on ventilation, states that in mines it is common for the men to work in an atmosphere too impure to allow a common candle to burn, though an oil lamp, in consequence of its greater tenacity of combustion, may be maintained in action without difficulty. Mr. Buddle, in his evidence before a Committee of the House of Commons, on accidents in mines, states, "That in his own experience, he knows that carbonic acid gas may be breathed when no flame will exist in it; and has had occasion, frequently, to travel in a mixture of this kind when a candle would not burn, and a steel mill give hardly any sparks. He feels oppression of breathing, not by any means dangerous, while the steel mill will elicit any sparks." Mr. Nicholas Wood, coal miner, of Northumberland and Durham, states in his evidence before the same Committee, that he has met with carbonic acid gas in such quantities that the candles would not burn in it; but the miners are not injured by it till a considerable time after the candles are extinguished. He has not known carbonic acid emitted in such quantities as to produce an immediate sense of sinking, and thinks that the lights being put out a considerable time before it injures the workmen, guards against any danger of that kind. From these facts we may infer, that as long as a candle exhibits the feeblest glimmer in a coal mine, there is little danger of life for a long time, provided we remove a large portion of the carbonic acid, and no other poisonous gas is present, as carbonic oxide. The danger is not immediate even after the lights are extinguished; and how much less imminent must it be if we are in possession of means of depriving the air of a large proportion of its poison. I do not anticipate that workmen will use this method, for the obvious reason that it would interfere with their work; besides they become acclimated to a carbonic acid atmosphere, in which a new comer could not live; but I think that an occasional suck through the apparatus for a quarter of an hour would revive them considerably. It would prove more acceptable to owners, surveyors, or coal-viewers, who enter an impure atmosphere occasionally only; or who have to explore localities which are not worked, whose atmospheric conditions are not known, and where the presence of choke damp may be suspected. Carbonic acid abounds chiefly in old workings and abandoned mines; when it is necessary to enter them the use of the apparatus would, I think, contribute much to the safety and convenience of the explorers.

It is for this purpose of rescue, that I conceive that the air purifier would be of the greatest value. An alarm is given by some one who has had the good fortune to escape, that his companions are overcome with the choke damp; to proceed unprotected to their help, is only to add to the number of the sufferers; but the apparatus will probably make the difference between respirable and irrespirable air, and enable us to approach and save those who would otherwise inevitably perish.

The explosion of fire damp is less fatal from the accompanying heat and violence, than from the vitiated air of the after damp. There is reason to believe that many die gradually of suffocation, after an explosion, in consequence of the abundance of carbonic acid, and deficiency of oxygen, caused by the combustion of the gases. Timely help might snatch these from destruction. It is extremely probable, that the air-purifying apparatus would, in some instances, render this after-damp comparatively innoxious, and enable us to rescue them. Some ready method of analyzing the foul air, or cautious trials to breathe it through the apparatus, would give some information how far we might venture.

I have stated that in my experiments more than one-half of the carbonic acid was removed by passing it through the caustic solution of soda: by enlarging the apparatus it would be easy to remove a much greater proportion. This might be done, either by having a greater depth of the solution above the perforated box, (say two inches, instead of one), or by passing the air to be purified through two vessels containing the solution. In the latter case it would be necessary to assist respiration, by forcing the air through the apparatus by means of a small pair of bellows under the arm into a bladder, which would become a reservoir of purified air, and to which a mouth-piece should be attached. This addition to the apparatus would not necessarily make it cumbrous and unmanageable.

It must not be forgotten, that the alkaline solution will only take up a certain quantity of carbonic acid, and that its power of absorbing is constantly diminishing. We will suppose that the solution contains 546 grains of caustic soda; and that 29 cubic inches of air, containing five per cent. of carbonic acid, are inspired at each inspiration, and that 20 inspirations are made in a minute: it results, by calculation, that the whole of the caustic soda would be converted into a carbonate in 80 minutes, supposing the air to be deprived of half its carbonic acid before each inspiration; but this is not the case, for as the quantity of caustic alkali diminishes its power of absorbing, carbonic acid will also diminish; but not rapidly, as I had the satisfaction to find by experiment. With a view of imitating the effect produced by a long continued passage of carbonic acid through the solution of caustic soda, I reduced the strength of the solution employed in the experiment by one-half, by diluting it with an equal quantity of water, and adding carbonate of soda, till the solution was saturated: this took place before the solution contained as much soda per cent., whether caustic or in the form of carbonate, as it did before the dilution. In passing a mixture of air and carbonic acid gas through the solution, I found that its power of absorbing the latter gas very little diminished; it still absorbed about 50 per cent. We may infer, therefore, that with a charge of 546 grains of caustic soda, and under the conditions above stated, the efficacy of the apparatus would be but little impaired after the lapse of 40 minutes; that is to say, after half its caustic soda had been converted into carbonate of soda. It is obvious that the charge of soda should vary, according to the impurity of the air and the length of time it has to be breathed. An experienced person would cease breathing through the apparatus when he had reason to believe the air sufficiently pure, and thereby husband his store of alkali.

DESIGN FOR A MAGNETIC BORING MACHINE. BY MR. JOHN THOMSON.

The enormous labour, delay, and other vexations attendant on rod boring, are well known, and do not require examples to enforce conviction; yet, strange to say, that same old awkward system even yet holds good its footing. The Chinese method, which is much more simple and effective, is being adopted in Europe. It consists of an armed weight (say one, two, or three hundred pounds, as the case may be) of a particular form, attached to a peculiar rope, to withstand the friction on the sides of the bore hole whilst at work, and being suspended from above by a spring, on which two men are seated. The weight is made to bob up and down by their exertions, striking the bottom at each depression of the spring, the boring being advanced with considerable rapidity. The clearing of the detached matter by this method is also very much facilitated, as compared with the rod-boring system.

These are the only two methods at present known for boring the earth to any great depth, and they do not admit of much improvement.

But I contend that other methods may be found to supersede these, and would suggest the powers of the electro-magnet, an agent whose limit of energy is yet unknown. The small space through which it can exert its immense power, renders it peculiarly adapted to boring purposes, either perpendicularly, horizontally, or at any other angle; being a particular advantage gained over any of the other methods, and quite applicable to direct mining.

Suppose, for instance, a short boring instrument to have a common magnet inserted into it, with the poles uppermost. Again; suppose a mate to this magnet, of the electro description, firmly inserted into a heavy weight. Next, let us imagine these two magnets to be set upon each other, face to face, the under one with its boring tool, and the upper with the weight. It will be evident that, by connecting an electro-magnetic battery to the upper magnet, and reversing the polarity as usual with that machine, a power will be exerted between these two magnets, tending, at each alternate reversal of polarity, to separate them and produce a shock. Such is the principle upon which I propose my mining machine. If the weight

lents—whether, in a word, it is or is not an evasion of the complainant's patent.

I have heretofore spoken of the principle of the patented machine, as involving the combination of a cutter-wheel with certain other parts. This language was sufficiently accurate, perhaps, for the purposes of the occasion, since there was then no controversy regarding a machine without a cutter-wheel. But it was rather a description of Mr. Blanchard's machine as in use, than a definition of its principle. The patentee evidently had a broader view of his invention. In his specification he says, "Moreover the cutters may be made sharp on both edges, and the cutter-wheel may be made to turn a quarter of a circle or less, backward and forward, and so the cutters be made to cut by both edges; but the continued circular movement is believed to be preferableto any other."

Now, when the cutters are acting with this alternate or reciprocating motion, they can scarcely be considered as moving on a cutter-wheel, implying, as this does, the idea of continuous rotation. The abstract principle, therefore, that shall include both forms of structure, cannot recognize the cutter-wheel, strictly speaking, as an element of the combination—but rather a cutter, or series of cutters, deriving motion from a circle, and acting in a circular arc.

If this were the correct definition of Mr. Blanchard's principle, the difference between the two machines would be resolved very easily. One, the patented, applies the revolving power immediately to its work, in the most simple, convenient, economical, and effective mode;—the other, the defendant's, interposes between the revolving power and the work an additional member that serves no purpose whatever, unless to avoid identity with the patented machine.

The patent law would give but an illusory protection to the meritorious inventor if it respected devices like this. It requires of a patentee that he shall disclose in his specification the most beneficial mode of applying his principle that is known to him. (Neilson's patent, *Webster Ca.*, 337.) But it does not require of him to go further, and point out all the possible contrivances by which the machine that illustrates his principle can be rendered less beneficial or less perfect. The more fully matured his discovery, the more complete his machine in all its parts, the more signally and immediately profitable to the community, the greater will be the number of the defects it has avoided or provided for, and the greater, of course, the number of changes for the worse that may be grafted upon it by a froward ingenuity. For surely ingenuity may be so styled, when it toils with inverted energies, not to improve or advance, but to devise something less useful and more costly than that which was known before.

But, in truth, the principle of Mr. Blanchard's invention calls for a less restricted definition than that which I have for the moment assumed. Strike out from his specification all the details of structure, or look through them into the inventive idea, the essential principle that resides within, and what do we find? A tracer, so arranged as to pass in a spiral or helix line over the surface of a model, while the rough material revolves in a similar line under a cutter, guided by the tracer, but acting with independent rapid motion; the combination of these for a declared purpose: this is the principle of the Blanchard patent. All the rest is detail, properly introduced into the specification, as exhibiting "the most beneficial mode of applying the principle," but essentially forming no part of it.

Now although it be true that, technically speaking, an inventor cannot claim a patent for the principle he has discovered, yet it is equally true that, if he has embodied it in any clear, definite, and distinct form, others will not be permitted to take that principle and embody it in some other form merely copied from his; "And thus," as was well argued in the case I have cited, "you may attain a result which is practically equivalent to the patenting of a principle;" for when you have put your intention into shape, no person will be allowed to come in and steal the spirit of your invention by putting it into some other shape, which, though different, is imitated from yours.

The defendant in this case has mistaken his legal rights, and the sooner he is advised of his error, the better for him and for the public. He is obviously possessed of considerable mechanical ingenuity, which, if applied in a different direction, may advance his own interests, while contributing incidentally to the interests of art. But he has confounded the details of Mr. Blanchard's machine with its principle; and in seeking to escape from the operation of the patent, he has violated the law by which it is guarded.

It is possible that he may have been misled by the language of the charge, when his case was before me on the law side of the court. Abstract propositions are liable to inaccuracy, when elicited in the haste of a trial at bar; and however accurate, they are not suited to the purpose of imparting instruction to a jury. I prefer, therefore, generally to employ illustrations, derived from the case itself, to convey the legal principle which should rule it, rather than to announce the law in general and abstract terms. It is enough for me if I can succeed in teaching all that belongs to the circumstances and the time.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 15TH OF JUNE.

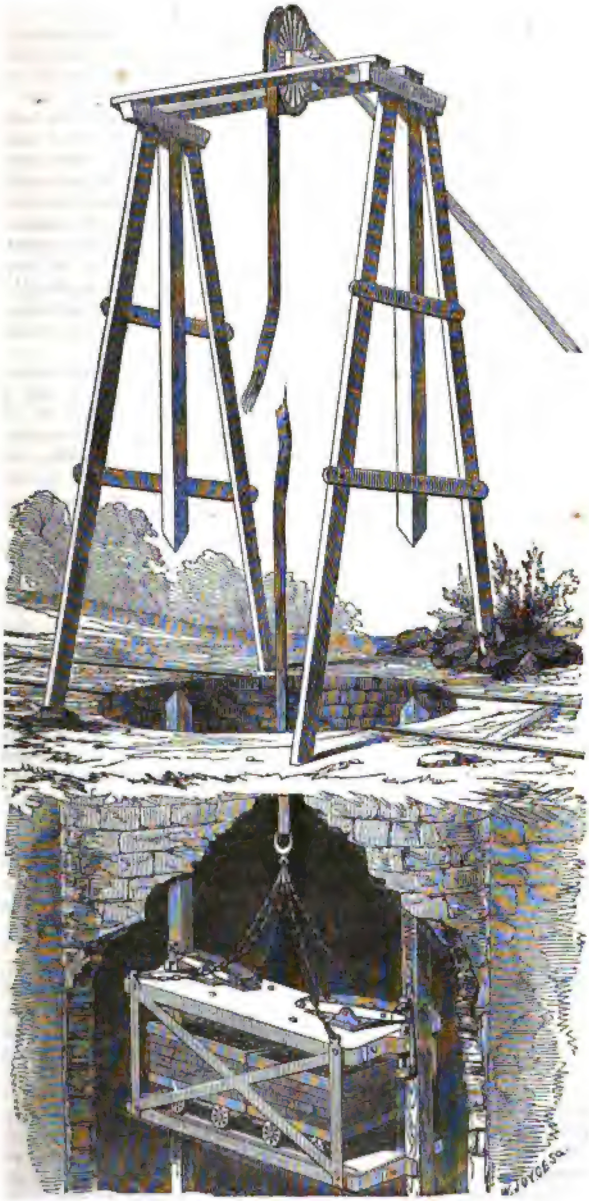
CONRAD HAVERKAM GREENHOW, London, civil engineer. *For certain improvements in atmospheric railways.* Patent dated January 13, 1849.

The improvements which form the subject of this patent refer to the very ingenious scheme of Messrs. Clark and Varley, and consist in an improved method of fixing the resilient tube, and in addition thereto of certain appliances whereby its efficiency is greatly increased.

The patentee proposes to suspend the resilient tube, at intervals of six feet, in a sling of malleable iron one-eighth of an inch in thickness and three inches broad, in such manner as to avoid damaging the tube by riveting. The sling is to be riveted to upright supports, one on each side, which are bolted down to the sleeper. The sling must embrace the tube on each side to within twenty-five degrees of the longitudinal slit on the vertex of the tube, and be riveted to the upright supports within the perpendicular lines which touch the tube at the extremities of its horizontal diameter. By this means the weight of the tube in the sling will have a tendency to draw the points of the standards or upright supports together, and their pressure on the tube will assist its elasticity in closing the longitudinal slit after the passing of the coulter. To facilitate the opening of the longitudinal slit for the passage of the coulter, Mr. Greenhow attaches to an iron plate, placed parallel with the horizontal diameter of the tubes, and at right angles with the coulter, four horizontal wheels, two inclined towards one side of the tube, and two towards the other. The distance between the extreme edges of the wheels should be one-half of an inch greater than the internal diameter of the tube, so that as the wheels advance through the inside of the tube, they shall increase its horizontal diameter, and cause the longitudinal slit to open to twice the distance of the increase in the horizontal diameter (the transverse section becoming then slightly spheroidal). The coulter is secured to the top of the plate, and the intervention of that plate prevents the coulter from coming in contact with the wheels as it passes between the parted edges of the longitudinal slit. To ensure that the wheels shall remain precisely parallel with the horizontal diameter, and thus prevent the coulter from oscillating out of the perpendicular, which might cause an abrasion between it and the edges of the slit, Mr. G. attaches to the side of the coulter a wheel with grooved periphery, which fits and runs upon a rigid rail riveted to the top of the tube on one side of the slit, and extending through its entire length, so that any tendency which the coulter might have to swerve is corrected by the rigidity of the guide rail. To attach the coulter to the piston, he makes use of a tube of malleable iron, three inches in diameter, which passes quite through the piston, and is fixed at the other end in the plate to which the wheels for opening the slit are secured. Care must be taken to have sufficient distance between the wheels and the piston, to prevent the opening in the slit from extending as far as the piston. The coulter, which consists of a plate of steel three-eighths of an inch in thickness and three feet long, is secured to the plate directly above the wheels, in order that it may pass through the opening made in the slit by the wheels. Immediately behind the coulter there is a valve in the tube which forms the piston rod, and by opening this valve, air will pass through the piston rod into the exhausted tube before the piston, and so assist in retarding the train, by destroying the vacuum, in case of any emergency occurring to render it necessary to do so. To strengthen the connection of the tube and piston with the coulter and plate, Mr. G. places an iron bar, one-fourth of an inch thick and four inches broad, under the wheels, and makes it fast at one end to the piston. The manner of attaching the coulter to this leading carriage is as follows:—To each end of the coulter are secured by three links two wedge-shaped pieces of iron, which are drawn through a strong plate of iron in the perch of the leading carriage, whereupon another wedge-shaped piece of iron, attached to a lever, is forced in between them. When in this position, the two pieces attached to the coulter cannot fall out or be withdrawn, and consequently, the attachment of the coulter and piston to the perch of the leading carriage remains perfect. By raising, however, the levers, the wedges fixed to them are withdrawn, and those attached to the coulter being released, fall through the plate, and the carriage is instantaneously freed from the coulter in case of need.

To produce the requisite degree of rarefaction in the traction tube, Mr. Greenhow connects it with vacuum chambers exhausted in manner following:—"Fig. 11 is a plan of my arrangements for this purpose, and fig. 12 a vertical section of them on the line E F. A A are two chambers of equal size, each of cubic contents equal to those of the length of tube intended to be exhausted at one time. M M are two pipes, that lead from

FOURDRINIER'S PATENT SAFETY APPARATUS FOR PREVENTING ACCIDENTS IN MINES AND COLLIERIES.



By the adoption of this invention the lives of the working miners may be preserved, and the property of the mine owners protected from the serious consequences of the following accidents:—

1. From the men or load being precipi-

tated to the bottom of the shaft when the rope or chain breaks; in this case the apparatus is self-acting.

2. From either the men or load being drawn over the pulley; in this case also the apparatus is self-acting.

The apparatus is readily applied to the present guides now in use, whether they are of wood, iron rods, or chain, and may be attached to the cage in a few hours.

By reference to the prefixed sketch it will be seen that the apparatus is fastened upon the guides by the rope being represented as broken, but when the rope or chain is tight, and the cage in work, the levers are raised on their fulcra, and lower the wedges in the tapered shoes, which slackens them on the guides; and when the rope or chain becomes broken or detached, the levers drop and raise the wedges into the tapered shoes, and consequently grip the guides firmly on both sides, so that the greater the weight in the cage, the tighter the wedges hold.—*Mining Journal.*

LAW OF PATENTS.—AMERICAN CASE.

Blanchard's Gun-Stock Turning Lathe.

Opinion delivered by Judge Kane in the United States Circuit Court in the case of Blanchard *v.* Eldridge, on a motion for attachment because of a breach of injunction—for an infringement of Blanchard's Gun-Stock Turning Lathe as applied to turning Shoemakers' Lasts, March 8, 1849.

The patent right of Mr. Blanchard has been the subject of examination before me in two trials at law, the present defendant being a party. Although no verdicts were rendered, I was fully satisfied by the evidence, that the patent was a highly meritorious one, of ancient date, and that the defendant had violated it. I did not hesitate, therefore, to grant an injunction against him, upon the proper proceeding being instituted in equity. This injunction being still in force, the defendant has devised a new machine, and is now using it, as the complainant asserts, in violation of the injunction. The question is thus presented, whether the new machine of the defendant infringes the complainant's patent right?

In my charge to the jury on the other side of this court, I spoke of Mr. Blanchard's machine as follows:—" It is a turning machine, capable of producing with rapidity from the rough material, by a single operation, an irregular form, similar or proportional in all respects to a given model. It consists essentially of a model, revolving in contact with a friction tracer, while the rough material revolves, with the same velocity, in like contact with a rapidly moving cutter-wheel; either the model and material, or else the friction tracer and cutter-wheel, having a progressive lateral motion, so that by the revolutions of the model and material all the points of their respective surfaces are presented in succession to the touch of the friction tracer and the action of the cutter-wheel respectively; that is to say, all the points on the surface of the model successively to the touch of the tracer, and the corresponding points on the surface of the material to the action of the cutter-wheel. Its value consists in this, that it combines the accurate imitation of a slowly-revolving model with the rapid action of a cutter-wheel. Its principle is the combination of the cutter-wheel, model, and friction tracer, with the arrangement for effecting the lateral motion."

Between this and the respondent's present machine there appears to be but a single point of difference.

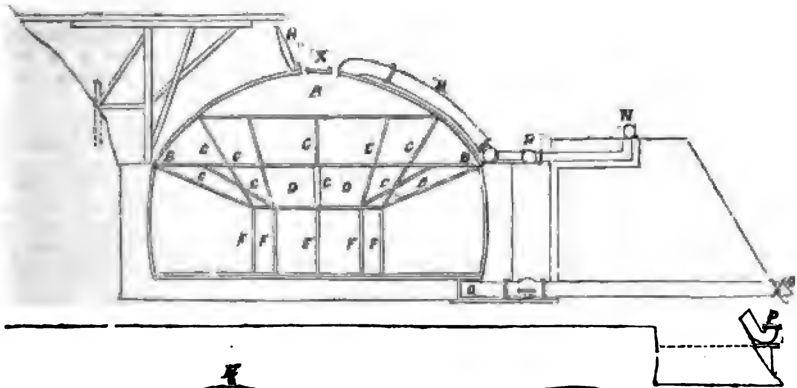
"The peculiar novelty of the respondent's machine, according to the report of the Commissioner, William W. Hubble, Esq., appears to be in the formation, suspension, and manner of propelling the cutting instrument, to shape the last from the rough block without finishing. The cutting instrument consists of a double-edged curved knife of about the same curve or periphery as the friction column; it is bolted to a perpendicular iron bar, about an inch square, which plays up and down between and through two iron straps, fastened to the main transverse carriage. This cutting instrument receives its motion from a pitman, attached to a crank, put in very rapid revolution, and thereby with great velocity moves the cutting instrument in a straight perpendicular line up and down, which being sharp on both the upper and lower edges, in passing the rough material, cuts it both in its ascent and descent. Attached to the crank shaft are a fly-wheel and a balance weight."

The two machines, then, have the same object; and they attain it by the same means, operating in the same manner, except that Mr. Blanchard's cutters are set on the periphery of a wheel, and act in the curved line of its motion, while in Mr. Eldridge's the circular motion is transferred to a shaft, and the cutters, being affixed to this, act with an alternating movement in a right line.

It is not contended that the shaft is an improvement on the wheel, that it is more economical of structure or use, or that it does its work more effectively or rapidly. On the contrary, it is evident that, if well made, it must be more costly at first, that it must exact the expenditure of more power in working, must do the work less rapidly and less perfectly, and must be less durable. The only question to be decided is whether it differs in principle, or by a modification of details merely, a substitution of equiva-

the chambers, A A, to one common connecting tube, S, which terminates by two branches in the railway tube or atmospheric main, N. R. R. W. W, are two sets of valves, by which the communication between the pipes, M M and S, is regulated. The chambers, A A, are made of boiler plate, and set in brickwork up to the point, B, from which point the roof is the section of a sphere supported by eight stays, C C, springing from a strong circular ring, D, which rests on perpendicular supports, F. The stays, C, ring, D, and supports, F, are all made of malleable iron tubes, of a thickness

Fig. 12.



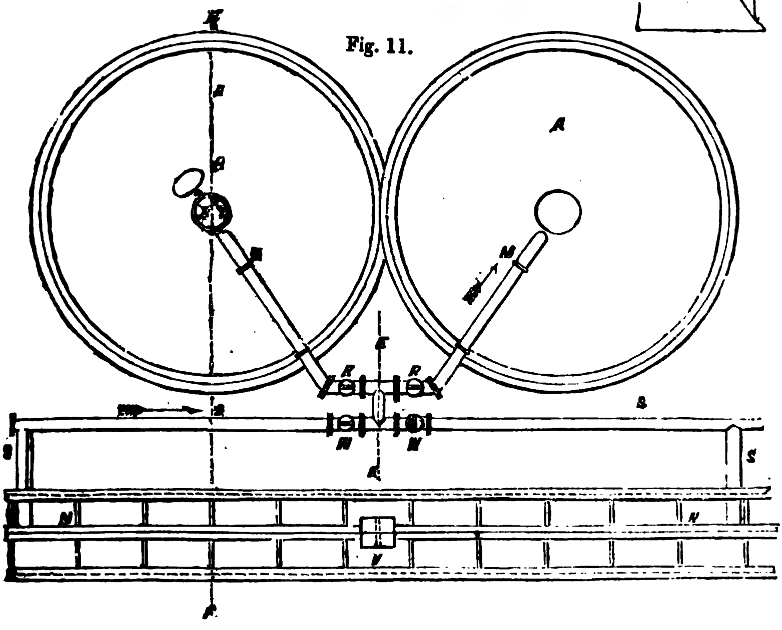


Fig. 11.

proportional to the size of the chamber. In the centre of the roof there is a circular opening, *x*, packed all round with felt, on which the lid, H, rests when closed. At the bottom of the chamber there is a pipe, O, for the escape of the water, by opening the valve, T. The mode of operation is as follows:—The valve, T, in the escape pipe, O, is closed, and the water allowed to flow into the opening, X, until the chamber, A, is full. The lid, H, is then closed, and also the valve, R, in the connecting pipe, M. The valve, T, in the escape pipe, O, is next opened, when the water flows off, escaping at the outlet, P, which must be thirty-four feet below the level of the bottom of the

chamber. The water will now, by the natural effect of gravity, leave the chamber and the pipe, O, until it is balanced by the atmospheric pressure at the outlet, P, and will stand in the pipe, O, at a height equal to the amount of vacuum created in the chamber, A, which, in ordinary cases, will be equal to a column of water of about twenty-eight feet, making due allowance for the air which will escape from the water into the vacuum chamber. Now, by closing the valve, T, in the escape pipe, O, and opening the valve, R, in the connecting pipe, M, the air in the tube, N, will expand into the exhausted chamber, and thus rarefy the air in the tube, N, and give motion to the piston by the atmospheric pressure on the outside of A. When the greatest effect has been obtained from one chamber, the valve, R, in the connecting pipe, M, may be closed, and a like operation be performed with the other chamber, and by this means a great amount of pressure on the piston will be obtained. By closing the valve, V, on the tube, N, and opening either of the valves, W, in the connecting pipe, S, the effect of the vacuum may be communicated in either direction.

Claims.—1. The suspending of the tube in slings, as before described.

2. The employment of horizontal wheels within, and of greater diameter than the traction tube, in order to widen the horizontal slit for the passage of the coulter, as before described.

3. The employment of the grooved wheel and rigid guide rail, to prevent the swerving of the coulter, as before described.

4. The modes of attaching the coulter to the piston and to the leading carriage, each as before described.

5. The employment of an exit valve of the peculiar construction before described. And

6. The obtaining of a vacuum by causing water to fall from an air-tight vessel or vessels to its barometrical level, as before described.

RICHARD DUGDALE, Brompton, Middlesex, engineer. *For improvements in hardening articles composed of iron.* Patent dated January 13, 1849.

The article to be steeled is placed in an iron case, and is surrounded with the carbonizing powder which is compounded of 100 lbs. of charcoal, ½ lb. borax, ½ lb. sal ammonia, and ½ lb. sulphur. The case and its contents are exposed to from red to white heat; for a space of time, varying from four to twenty-four hours, according to the depth to which the article is desired to be carbonized. When a portion of the article is not required to be steeled, it is prevented from coming into contact with the carbonizing powder by being covered with clay or sand.

Claims.—1. The use of the ingredients, or their equivalents, compounded as described. And

2. Their application, as described, so as together to produce an improved process and economical means of hardening or carbonizing iron, or the surfaces of iron, to any depth, whether in the state of rough iron bars or of manufactured articles.

WILLIAM BETTS, of Smithfield-bars, London, distiller. *For a new manufacture of capsules, and of a material to be employed therein, and for other purposes.* Patent dated January 13, 1849.

The material employed consists of thin plates of metal formed by causing a plate of tin to adhere to a plate of lead, by means of pressure produced by rolling. The compounded plates so formed by the lead having tin on both sides, or on one only, may be employed for lining cisterns, &c., and by being made into a thin foil, may be employed for covering walls, &c.

Claims.—1. The compound plates or foil formed by causing tin to adhere to lead by pressure.

2. The application of the same to making capsules.

GEORGE WILLIAMS, of Tipton, Stafford, forge manager. *For a certain improvement or certain improvements in preparing puddling furnaces used in the manufacture of iron.* Patent dated January 13, 1849.

It has heretofore been the practice to form the lining of puddling furnaces with scoria dust and slag,—a practice which causes considerable waste of iron. The patentee forms these substances into bricks, with which bricks he builds the interior of the furnace, using a paste of the same materials for mortar.

Claim.—The making of bricks or plates of scoria and slag, for lining the interior of puddling furnaces.

JEANE BAPTISTE FRANCOIS MAZELINE (ainé), of Havre, engineer. *For improvements in steam engines, and in the machinery for propelling vessels.* Patent dated January 16, 1849.

The "improvements in steam engines" consist in the employment of a slide valve, the cross section of which is the frustum of a cone. The steam passages are upon the two sides, so that the valve is not affected by the pressure of the steam, and is, therefore, moved with very "little power."

The improvements in propelling consist in the arrangement of two horizontal cylinders end to end, the piston rods of both cylinders being connected to separate crank shafts, each of which carries a spur wheel; the spur wheel of both shafts gearing into one pinion, on the screw propeller shaft.

Claims.—1. The slide valve described.

2. The arrangement of cylinders for transmitting the power to the screw shaft propeller.

EDWARD BUCKLER, London, merchant. *For improvements in the manufacture of boots and shoes, also applicable to other fabrics.* Patent dated January 16, 1849.

Claims.—1. The combining of the different parts of boots, shoes, pipes, and leather tanks together by means of wire fastenings.

2. A peculiar construction of dies for forming the heels, soles, &c., of boots and shoes.

CAREY MCCLELLAN, Larch Mount, Londonderry. *For an improved corn mill.* Patent dated January 16, 1849.

Claims.—1. A mode of forcing or driving air, by blowing apparatus, through hollow radiating rotary arms, so as to bring the air more between the stones or grinding surfaces of a corn mill.

2. An improved arrangement of the feed pipe and cap, in combination with improved air-driving apparatus, whereby the substance to be ground is brought opposite to the space between the stones or grinding surfaces of the mill; that is to say, made to follow the direction of the air through the hollow radiating rotary tubes.

WILLIAM MARTIN, St. Pierre les Calais, France, mechanist. *For certain improvements in machinery for figuring textile fabrics, parts of which improvements are applicable to playing certain musical instruments, and also to printing and other like purposes.* Patent dated January 16, 1849.

Claims. — 1. The combining of perforated paper, vertical needles, and presser-bars for selecting and acting on horizontal rods, by means of which the warp threads of the pattern are selected.

2. A peculiar combination of perforated pattern-paper and bent rods, supported, upon horizontal spindles in the knee parts, whereby the warp threads are selected and acted upon for the production of the pattern.

3. The combination of pattern-paper with pegs capable of sliding in or out of a cylinder, and for striking against or not, as the case may be, levers which strike the strings or other tone-giving substances of keyed musical instruments (barrel organs, &c.)

4. The combination of pegs sliding in a cylinder, for actuating the levers of type-composing instruments.

5. A peculiar arrangement of mechanism for transferring the pattern which has been punctured on ruled paper to the pattern-paper.

PETER AUGUSTINE GODEFROY, London, chemical colour manufacturer. *For certain improvements in dressing and finishing woven fabrics.* Patent dated January 16, 1849.

Claims.—1. The fixing colours in woven fabrics by mordants applied in a state of vapour.

2. The subjecting of woven fabrics to pressure by means of a roller, as it passes in a damp and smooth state to the cylinder, and drying it afterwards when in this compressed state.

ANTHONY BARBERIS, of Leicester-square, engineer. *For improvements in spinning silk and in the construction of swifts, and in the arrangement of apparatus for winding silk and other fibrous substances.* Patent dated January 16, 1849.

The first of these improvements relates to the construction of the "swifts," the arms of which are made in two pieces, so that by arrangements shown, they may be expanded more or less at pleasure, and their diameter increased or diminished accordingly.

A second improvement consists of a similar arrangement for enlarging the diameter of reels.

These two improvements constitute the subjects of the Claims.

THOMAS NEWCOMB, of Bermondsey, machinist. *For improvements in furnaces.* Patent dated January 18, 1849.

These improvements consist in having the fire-bars, which are laid crosswise, inclined at an angle towards the back of the furnace, and connected in two sets to reciprocating levers, each alternate fire-bar being connected to the same lever. As the levers reciprocate —which is effected by cams—the fire-bars move up and down in the furnace, and not only cause the fuel to advance toward the further end, but prevent all clinkering.

Claim.—The means employed for moving the bars in the alternating manner described.

JOHN FRANCIS BOTTOM, of Nottingham Park, Nottingham, lace-dresser, and JOHN DEARMAN DUNNICLIFF, of Hyson-green, Nottingham, lace manufacturer. *For improvements in dressing or getting up fabrics of cotton or silk, and of cotton and silk combined.* Patent dated January 18, 1849.

These improvements consist,

1. In the application of jets of free steam to the fabrics, while in a distended state, by machinery represented in drawings appended to the specification.

2. In applying heated air to dry the fabrics, which is supplied in numerous jets, while the fabrics are in a stretched state.

Claims.—1. The application of free steam to the dressing or getting up fabrics of silk or cotton, or of cotton and silk combined.

2. The drying of the same by numerous jets of heated air.

JAMES HAMILTON, of London, civil engineer. *For improvements in cutting wood.* Patent dated January 18, 1849.

These improvements have relation to mills employed for cutting veneers by means of cutters with curved edges. The substance of the invention will be understood from the Claim, which is for the employment of a revolving cutter with curved edges, used in combination with a reciprocating cutter-gate.

FRANCIS ALTON CALVERT, of Manchester, mechanist. *For certain improvements in machinery for cleaning and preparing cotton, wool, and other fibrous substances.* Patent dated January 18, 1849.

The improvements which form the subject of this patent, consist chiefly in covering the working surface of the cylinder of the machines for cleansing cotton, with wire wound upon it in a spiral direction from end to end; the working surface of the wire is serrated, so that it may act more efficiently in cleansing the cotton.

Claims.—The arrangements described, together with a pressing lever, of which a drawing is given.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal for May*, 1849.]

FOR AN IMPROVEMENT IN STEAM AND VACUUM GAUGES. *Paul Stillman.*

Claim.—" What I claim as my invention is, 1st. Combining with the reservoir of mercury, at the lower end of the gauge tube or tubes, an elevated bulb or chamber, to form part of the reservoir, substantially as described, that the level of the mercury in the tube may at all times be sufficiently high in the tube to be visible.

" 2nd, I claim making the bulb or reservoir of such capacity, in combination with the partial exhaustion of the tube of the steam gauge at the time of charging the instrument, as that the tension of the air above the mercury in the tube, when a partial vacuum is produced in the boiler, shall not be sufficient to force all the mercury out of the tube, as described, whereby the quantity of air in the tube shall be always the same.

" 3rd, I claim surrounding the lower edge of the glass tube with a metallic gland or tube, provided with a cap at bottom, through which the mercury can pass slowly, to establish the connection with the reservoir, substantially as set forth.

" 4th, I claim the method of preventing the passage of moisture from the surface of the mercury in the reservoir, between the mercury and the metallic gland, by tinning the outer surface of the gland, that the mercury may adhere thereto sufficiently to effect the purpose desired.

" And lastly, I claim preventing the glass tube of the steam gauge from being soiled by the oxydation of the mercury within it, by introducing within the tube, and on the surface of the mercury therein, naphtha, or any other fluid which will prevent the oxydation of mercury, substantially as described, and thus preserve the glass tube in a clear and transparent state, as set forth."

FOR AN IMPROVEMENT IN ATMOSPHERIC CHURNS. *Nathan Chapen.*

The patentee says,—" The nature of my invention consists in arranging within a suitable box or case in which the cream is placed, two or more buckets secured to horizontal journals, and revolving with the same, in such a manner in relation to the surface of the cream, as to alternately carry, at each revolution, a body of air with them below its surface, and to release the same near the bottom of the case, and allow it to ascend in bubbles through the cream, to the space above the same, and to convey a quantity of cream above said surface, and discharge it from the buckets into the space above, near the top of the case, thus causing the fatty substance of the cream to be brought into contact with the oxygen of the atmosphere, and speedily formed into butter."

Claim.—" What I claim as my invention, is forming the paddles of the revolving wheels with buckets of the peculiar shape described, for the purpose of raising the cream nearly to the top of the churn, and discharging it through the air therein admitted through the aperture in the lid, as well as breaking up the cream by the revolving of the buckets through the cream, by which the butter is produced in a very short period of time; said buckets conveying the air to near the bottom of the churn, and discharging it through and amongst the cream, by which the oxygen of the air is brought into close contact with the fatty substances of the cream, and by which they are caused to incorporate readily into a solid mass in the form of butter, as set forth."

FOR AN IMPROVEMENT IN SEPARATING GOLD. *Isaac Babbitt.*

The patentee says,—" The nature of my invention consists in the causing of the gold or silver which is to be separated from the ore, or from other foreign or extraneous matter with which it is mixed or combined, to form an alloy with lead, instead of amalgamating these metals by means of mercury, as has heretofore been practised; and this I effect by taking the ore of the metal, duly pulverized and washed, or pulverized only, as may be found most convenient, in which I govern myself according to the nature of the ore and other attendant circumstances; or I take the sweepings or other admixtures of the precious metals, and prepare them by burning, washing, or other known means,

for the more easy combination of the contained metal or metals with the lead."

Claim.—"What I claim as my invention is, the exposing of the ore or ores, or combination or admixture of the precious metals with foreign materials, together with metallic lead and charcoal, sal ammoniac, or other flux, in closed vessels, in which the whole may be subjected to red heat, for the purpose of causing the precious metal or metals to combine with the metallic lead, instead of amalgamating the same with mercury, for the purpose and substantially in the manner set forth, without intending to confine myself to any particular mode of constructing the apparatus used, but to vary this as I may think proper, whilst the principle of operation remains the same. In the apparatus I claim, in combination with the vessel containing the molten lead, and provided with an aperture for the discharge of the impurities, and another for the discharge of the lead, the rotating plate, provided with the hollow arber for the supply of the ore, &c., and with the teeth for carrying the ore towards the periphery, substantially as set forth. And finally, I claim the method, substantially as herein set forth, of charging the apparatus with the ore, &c., without admitting air, in combination with the method of carrying the ore, &c., through the apparatus, and over the surface of the lead in the vessel, as described."

FOR AN IMPROVEMENT IN THE MACHINE FOR OPERATING, WORKING, OR MANIPULATING MORSE'S ELECTRO-MAGNETIC TELEGRAPH. *Edward R. Roe.*

The patentee says,—"My invention consists, 1st, of moveable metallic types, as conductors of electricity or galvanism; 2nd, a metallic type bed upon which they are to rest (which is also moveable to and fro, somewhat in the manner of a common printing press;) and 3rd, a moveable board, which is also a conductor, and is made to traverse the face of the types, thereby making, continuing, or breaking the galvanic circuit, according to the forms of the types."

Claim.—"What I claim as my invention is, 1st. The combination of the body, the socket, the spiral ring, and the wand, with its conducting point and its non-conducting inclined planes, the whole constituting the traverser.

"2nd. I claim the manner of giving the proper motion to the traverser, by the combination and action of the traverse wheel, the pulley, and the cord which plays in it, the teeth upon the traverse wheel, and the brakes operated by the type bed, in the manner set forth.

"3rd. I claim the combination, for telegraphic purposes, of the types, arranged in the manner described, with the traverse, and its wand, and its conducting point, guarded by non-conducting inclined planes."

THE UNREASONABLENESS OF SCIENCE.

(From *Punch.*)

An individual named Charles Cameron, a chemist, has put an advertisement in the *Times*, addressed to the subscribers to the Royal General Annuity Society, soliciting their votes at their next election, on the 30th instant, and also to non-subscribers, requesting pecuniary assistance; for every five shillings on the day of election would, he says, secure him five votes. The claim of this Mr. Cameron to the consideration of the benevolent rests principally on the circumstance that "he was the first who discovered and made public that splendid light which has long been employed at the Polytechnic for displaying the minute wonders of creation by the opaque microscope, to the gratification and mental improvement of millions." A mighty pretty title this to national gratitude! The idea of anybody thinking to be rewarded for discovering a new light, or contributing in any way to the enlightenment of his countrymen!

To have the slightest reasonable expectation of a decent annuity, a man ought to have cut an army to pieces, or destroyed a fleet, or burnt an arsenal, or at least blown up a bridge. Not any mischief in the world has Mr. Cameron done, and yet here he comes forward to ask for remuneration. What do we, the British public, care about science, or those who cultivate it? what good does it do us to know anything about the minute wonders of creation? Talk of the gratification and mental improvement of millions!—The misery and destruction of millions would have been a better recommendation for Mr. Cameron. But, as he is now in the seventy-fourth year of his age, and for the last two years has been in extreme distress from having lost the use of his right arm: whilst, since the gold medal of the Society of Arts has been twice awarded to him, there can be no doubt of his scientific merits; it is very probable that some weak-minded persons may be disposed to succour him, and we reluctantly pander to the morbid susceptibility of such people by stating that any contribution for that purpose may be sent to Joseph Clinton Robertson, Esq., Editor of the *Mechanics' Magazine*, 166, Fleet-street, before the 30th inst. Considering the kind of estimation in which science and scientific men are generally held among us, we do not wonder that Mr. Cameron has been for three years an unsuccessful applicant for the bounty of the Annuity Society; and now that he has once more applied for it we can only say we wish he may get it.

CHANCERY COURT.

[Before Vice-Chancellor Wigram, 17th July, 1849.]

BETTS v. WALKER AND BREFFITT.

This was a motion by the Solicitor-General (Mr. Webster was with him) to restrain the defendants from making bottles, which the plaintiff alleges to be made in violation of his patent of 30th December, 1844, for an invention intituled "Certain improvements in bottles, jars, pots, and other similar vessels, and in the mode of manufacturing, stopping, and covering the same,"—the infringement complained of being the making of the neck of each bottle with what the plaintiff calls an internal bearing shoulder.

The defendants (who carry on business as the Aire and Calder Bottle Company) make their bottles under a patent which they have purchased, and which was granted to A. S. Stocker on the 28th May, 1846, for an invention intituled "Improvements in the manufacture of bottles and other similar vessels, and in the manufacture and application of the whole or part of the articles to be used;" and they contend that the inventions are distinct.

Mr. Page Wood, Q. C., Mr. Hindmarsh, and Mr. Smith appeared for the defendants to oppose the motion; and after a short discussion, an order was made, by consent, that the motion should stand over until the plaintiff shall try an action and establish his patent in a court of law.

WEEKLY LIST OF NEW ENGLISH PATENTS.

George Cottam and Edward Cottam, of Winsley-street, Oxford-street, engineers, for improvements in machinery for cutting straw, clover, and hay; for grinding, for sawing wood, and in apparatus for ascertaining the power employed in working machines. July 12; six months.

Evan Leigh, of Ashton-under-Lyne, cotton spinner, for certain improvements in steam engines, and also improvements in communicating steam or other power for driving machinery. July 18; six months.

Reuben Plant, of Holly Hall Colliery, Dudley, Worcester, Coal Master, for improvements in making bar or wrought iron. July 12; six months.

Thomas Walker, of Birmingham, stove manufacturer, for improvements in boots and shoes, and in the manufacture of parts of boots, shoes, clogs, and goloshes. July 18; six months.

James Usher, of Edinburgh, gentleman, for improvements in machinery for tilling land. July 18; six months.

Andrew Peddie How, of the United States, now residing in Basinghall-street, engineer, for an instrument or instruments for ascertaining the saltness of water in boilers. July 18; six months.

John Holland, of Larkhall Rise, Clapham, gentleman, for a new mode of making steel. (Being a communication.) July 18; six months.

Samuel Cunliffe Lister, of Bradford, York, Esq., and George Edmond Donisthorpe, of Leeds, in the same county, manufacturer, for improvements in preparing, combing, and spinning wool. (Being a communication.) July 18; six months.

William Brown, of St. James's, Clerkenwell, machinist, Henry Mapple, of Child's Hill, Hendon, electric engineer, and William Williams, the younger, of Birmingham, gentleman, for improvements in communicating intelligence by means of electricity, and improvements in electric clocks. July 18; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
July 12	1956	Simcox and Pemberton	Birmingham	Hinge and door for letter-boxes.
13	1957	Walter Hart	New-road, Brighton	The Sikh buckle.
,,	1958	Deane, Dray, & Deane	King William-street	Alarum letter-box.
14	1959	James Hardcastle	Firwood, near Bolton-le-Moors	Calender for finishing muslin and other goods requiring such process.
,,	1960	Bedington & Docker	Birmingham	Solar shade for the outside of windows.
16	1961	Victor D'Anglais	Elin Cottage, Lymington	Epicurean oven.
,,	1962	Charles Burrell	Thetford	Gorse machine.
,,	1963	Charles Burrell	Thetford	Corn dressing machine.
,,	1964	John Heather	Bedford-court, Covent-garden	Petticoat.
18	1965	John Chubb	St. Paul's-churchyard	Railway strong box.
19	1966	Charles Clarke	Birmingham	Letter-box plate, applicable also to door-knockers.

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Being so extraordinary a conductor of sound, is used as speaking tubes in mines, manufactories, hotels, warehouses, &c. This tubing may also be applied in Churches and Chapels, for the purpose of enabling deaf persons to listen to the sermon, &c. For conveying messages from one room to another, or from the mast-head to the deck of a vessel, it is invaluable. For greater distances the newly-invented Electric-Telegraph Wire covered with Gutta Percha is strongly recommended.

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The increasing demand for the Gutta Percha strapping for driving bands, lathe-straps, &c., fully justifies the strong recommendations they have everywhere received.

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☞ *A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the substance of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d.*

Errata.—In Mr. Mansfield's letter, p. 36, col. 1, line 12 from the bottom, and following lines, instead of "In Mr. Beale's patent two lamps, &c.," read thus, "In Mr. Beale's patents three lamps are described, which come near to my method in some points, being air-and-naphtha lights; in one of these......&c......; in another the air is passed through......&c...... A few words quoted from the notice of his inventions in the Numbers of your Magazine, to which he refers, will show the principle of the third of these "lamps."

Also, in the same letter, p. 35, col. 1, line 1, for "light" read any other substantive in the language, particularly "plan," "method," "principle." P. 41, col. 1, line 9, for "railway" read "revolving."

CONTENTS OF THIS NUMBER.

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No. 1355.] SATURDAY, JULY 28, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

BROWN'S PATENT LIQUID METERS.

Fig. 1.

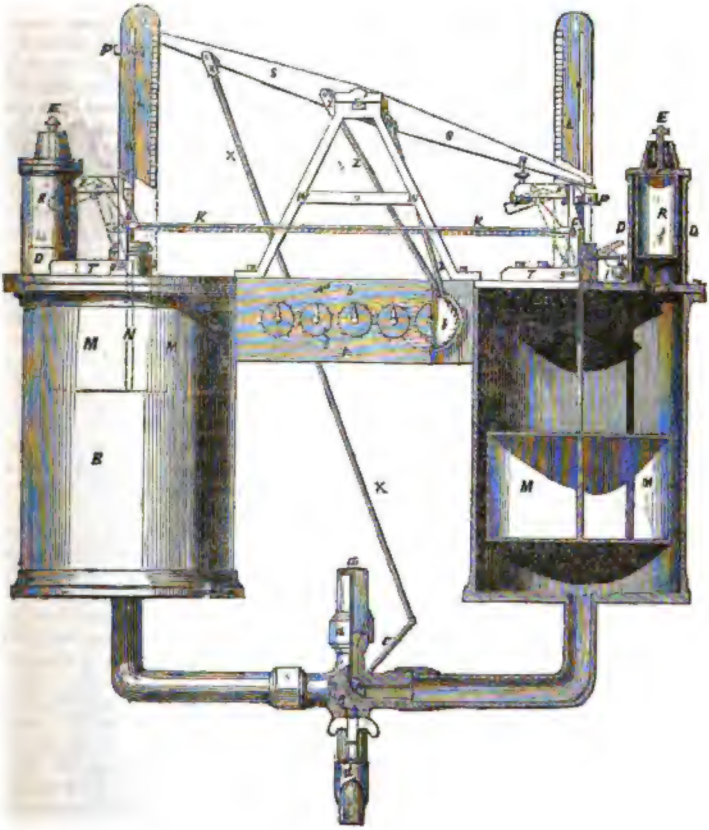
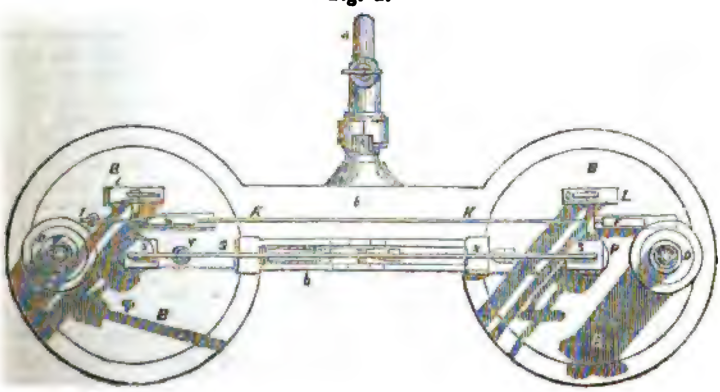


Fig. 2.



BROWN'S PATENT LIQUID METERS.

[Patent dated January 20, 1849. Patentee, Samuel Brown, the Younger, of Lambeth, Engineer. Specification enrolled July 20, 1849.]

Mr. Brown specifies and claims five different sorts of apparatus for "measuring and registering the flow of liquids, and of substances in a running state," such as shot, gunpowder, seeds, &c. We select, by way of example, the first, third, and fifth of these apparatuses; the first, because of the great ingenuity and beauty of its action; and the third and fifth because of their extreme simplicity, adaptability to general use, and probable cheapness. To all retail dealers in liquids, such as oils, spirits, beer, milk, &c., a good instrument of this sort must be invaluable.

First Apparatus.

Fig. 1 is a front elevation, partly in section, of this apparatus. A is a four-way cock, by which a communication is opened or closed, first between the source of supply and the measuring apparatus, and, second, between the measuring apparatus and the tap, *d*, by which alone the liquid is supposed to be withdrawn. B B are two cylinders which are precisely alike in their construction and appendages, and of which, therefore, one only need be here described. M is an air-tight float with a long stalk, N, which moves freely up and down through a stuffing-box in the cylinder cover. D is a small tube mounted on the top of the cylinder at one side, in the bottom of which there is an orifice, C, through which the liquid may ascend from B. R is an air-tight float (similar to M) which is connected with a valve, E, by which the tube, D, is closed and opened at top. L is an indicator, which is mounted on the top of the cylinder, and graduated to a gallon (or any other integral quantity) and the aliquot parts of a gallon. H is a pin, which projects from a boss, P, at the top of the stalk, N, of the float, and which, as that stalk rises and falls, moves up and down in a slot, *l*, in the indicator, L. Q is a pointer, which is attached to the pin, H, and points to the scale of parts on the indicator. F is a tumbler, which is attached to the upper and smaller end of a moveable inclined plane, G, which is centred on an axis, *g*, which is supported by a bearing piece, T, bolted to the cylinder cover. Both the tumbler, F, and inclined plane, G, are at right angles to the pin, H, which, on coming into contact with them from above, throws them back into the positions indicated by the dotted lines. I is a counterpoise, by which the tumbler and the inclined plane are restored to their original positions on being relieved from the pressure of the pin, H. The inclined planes of both cylinders are united by a cross-bar, K, so that whatever effect is produced on the inclined plane of one side, a like effect is produced on that of the opposite side. S is a cross-beam, which oscillates between the two cylinders, but is not attached to either of them, or to their float stalks, N; it turns on an axis, T', which is supported by a standard, WW, bolted to the top flanges of the cylinders, and derives its movement from the action of the tumblers and inclined planes, as will be presently explained. The office of this beam is to open and shut the passages of the four-way cock, A, by means of the levers, X and *c*, and to move by means of the pauls, ZZ, the ratchet wheels, *b b*, of the registering wheel-work, A[a], a given number of notches round, for every time either of the cylinders is emptied.

The mode of operating with the machine is as follows: Supposing both cylinders to be at first empty, the beam, S, is pressed down by hand on one side (it is indifferent which) into such a position as to open through the levers, X *c*, and the cock, A, a communication between the source of supply and one of the cylinders. The liquid will then flow into that cylinder till it completely fills it, as well as the small tube, D, at top (less only the space occupied by the floats M and R), driving the air before it out through the valve, E, which is closed by the float, R, as soon as the filling is accomplished. The other, or raised end of the beam, is next depressed also by hand, when the same course of action which has been just described is repeated, and the other cylinder also filled with the liquid and exhausted of its air; but with this addition, that the now depressed end of the cross-beam coming against the boss, P, of the float stalk, N, of the last charged cylinder, presses down that stalk till the pin, H, comes under the heel of the tumbler, F, and is kept down thereby, with the float attached to it, until relieved by the subsequent operations of the machine. The machine is now in a completely charged state, with both cylinders filled, and a passage open from one of them to the tap, *d*, as shown in fig. 1. But, before proceeding to measure with it—the falling distance between the boss, P,

of each float stalk, N, and the inclined plane, G, must be so adjusted by trial as to correspond exactly with the outflow of some determinate portion of the total quantity indicated on the scale; and this is readily accomplished by raising or lowering the position of the boss, P, on the stalk, N, which is provided for the purpose with an interior screw. Matters having been thus arranged, whatever portion of the liquid may be afterwards drawn off by the tap, *d*, must of necessity be indicated and registered by the apparatus, because as the liquid falls in the cylinder which is open to the tap, *d*, the float in that cylinder must also fall, and bring down along with it the float stalk, N, and pointer, Q, which last will point out on the indicator, L, during every stage of the descent of the stalk, the exact quantity which has been withdrawn; and when the pointer, Q, has descended to the bottom of the range allowed to it, the pin, H, catching against the tumbler, F, and inclined plane, G, will throw them, as well as the tumbler and inclined plane, on the opposite side (through the medium of

Fig. 3a.

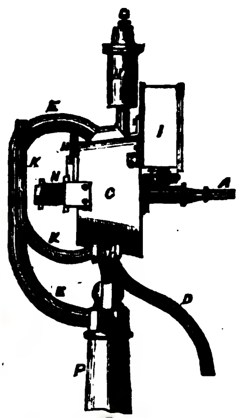
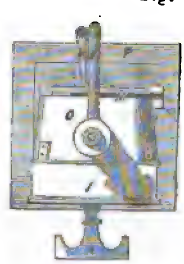


Fig. 2a.

Fig. 1a.

Fig. 5a.

Fig. 4.



the connecting-bar, K,) into the positions indicated by the dotted lines, and thereby set free the float of the second charged cylinder, the stalk of which was held down by the tumbler, F, on the opposite side, as has been just explained; whereupon the float of that second charged cylinder will, by its natural levity, instantly ascend, and its stalk, N, force up the beam, S, into a position the reverse of that which it just previously occupied; thereby reversing the relative positions of the ways of the cock, A; that is to say, turning the tap, *d*, open to the cylinder still to be emptied, and

opening a communication between the source of supply and the cylinder requiring to be refilled. And so the machine will continue to operate, as long as there is any liquid to be drawn off and measured; each rise of the floats producing a change in the ways of the cock, A, and causing one cylinder to be emptied as the other is filled, or *vice versâ*. Farther, as the position of the oscillating beam is reversed only each time, a quantity of the liquid, corresponding with the falling distance between the boss, P, of the float stalk, N, and the inclined plane, G, had been drawn off (such quantity having been ascertained as aforesaid), this furnishes an easy and infallible means of transmitting to the registering portion of the apparatus a mechanical indication of the fact. The pauls, Z Z, which are used for this purpose, are attached to the beam close to its axis, one on each side, so that the beam shall have quite completed its change of position, in each instance, before the paul, whose turn it is to act, can pass over the number of teeth of the ratchet wheel, corresponding to the said falling distance, which number must also be ascertained by previous trial. When it is desired to ascertain by inspection how much of the liquid has been withdrawn, all that is necessary, is to note the number of gallons in units, tens, hundreds, &c., entered up on the dial plate of the registering part of the apparatus, and to add the aliquot parts shown by the indicator.

Third Apparatus.

The *third* of the improved apparatuses aforesaid, is adapted to measuring and registering the flow, not only of liquids, but of other substances in a running state, as shot, gunpowder, seeds, &c. Fig. 1ᵉ is a front view of this apparatus; fig. 2ᵉ, a back view of it; fig. 3ᵉ, a side view; fig. 4ᵉ, a top plan; and fig. 5ᵉ, a cross-section through the centre. P is a pedestal or stand. C, a barrel or case, which is supported in a transverse position by scroll bearings from the top of the pedestal. B B, a plug, which is inserted into the case, C, and cut away on opposite sides, so as to leave on each side an open space of some determinate cubical capacity. N, a spring to keep up the plug to its proper bearing in the case; and O a bridge against which it abuts. A, is a handle to the plug, by turning which the positions of the ways may be altered alternately, so that at one time the case shall receive, and at another discharge, a quantity equal to the cubical contents of one division of the case; and T T are a pair of bevelled wheels by which each movement of the handle, A, is communicated to the registering wheel-work attached to the front plate, I. If the apparatus is intended to be employed for the measurement of dry goods, as shot, gunpowder, seeds, &c., a supply funnel must be affixed to the top of the case, as indicated by dotted lines in fig. 5, and in any case the discharge may take place through the tube, D. But for the measurement of liquids, the following modifications in, and additions to the apparatus, will require to be made. The pedestal should be made hollow and put in communication with the source of supply; and a pipe, E, be carried from the pedestal to the top of the case, C. A small cylinder, H, (which may be conveniently made of two diameters, as shown), must also be mounted on the top of the case, and communicate with it, containing in the upper or larger division of it a valve, G, through which the air escapes as it is expelled by the rise of the liquid. F, is a float, by which the valve, C, is closed on the whole of the air being forced out. K, is an air tube which communicates with the bottom of the case. The action of the instrument is as follows: Supposing the plug to be moved round, say to the right, as shown in fig. 5, so as to open a communication between the supply pipe, E, and the compartment of the case on the off side, that compartment will be immediately filled, as also the tube, H; and the air will be driven before the liquid through the valve, G, which will be closed by the rising of the float, F. On then giving a half turn to the plug, the liquid which has been so admitted will flow through D, and be facilitated in its escape by an inflow of air from K, while simultaneously therewith a communication will be opened between the supply pipe and the other compartment, which will in its turn be filled and emptied in the same manner. And so the operation may be continued indefinitely, one compartment being always discharged as another is filled.

Fifth Apparatus.

A *fifth* apparatus for measuring and registering the flow of liquids is represented in fig. 1ᵇ (a front elevation) partly in section, and fig. 2ᵇ (a sectional elevation). B is an air-tight hollow vessel of a pyramidal form. C, a broad wheel, which is mounted on bearings, F F, in the top of B, and consists of an axle with a number of cup-shaped leaves or arms radiating from it, but without any tyre. A separate view of this wheel on an enlarged scale is given in fig. 3ᵇ, on the line *a b*. D is a close chamber, which is attached to one end of wheel, C, and on the same axis, and is divided internally by plates curved in the same way as the leaves of the wheel, C, into as many

distinct compartments as the wheel has leaves; each of which compartments is permanently filled to a greater or less extent with shot. The liquid to be measured is received as it flows in from the supply pipe, A, in the cup-shaped leaves of the wheel, C, and as the wheel revolves, these discharge themselves upon an inclined plane, M, whence the liquid falls into the pyramidal vessel, B. E is an indicator (of the same kind as those before described) which is attached to the axis. G, a glass cover to the indicator. H is a discharge pipe. K, a grating inserted in the throat of the supply pipe, A, to break the flow of the water into the drum. And L a tap.

The mode in which the apparatus acts is as follows: Each compartment of the close chamber, D, is loaded with a given weight of shot or other suitable material (as shown

Fig. 1^b.

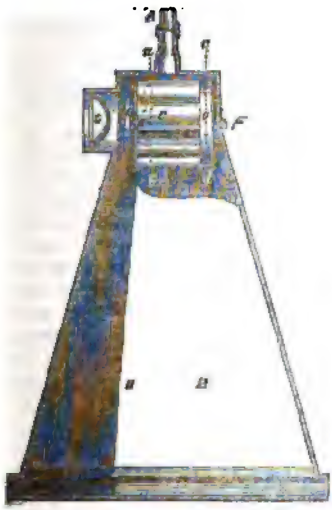


Fig. 2^b.

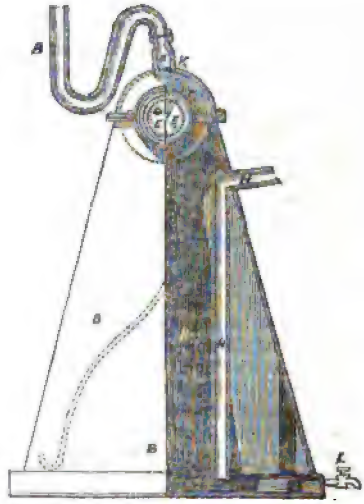
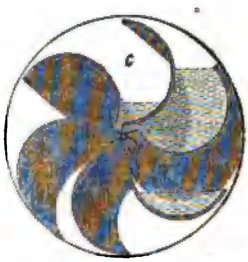


Fig. 3^b.

Fig. 4^b.



in fig. 4^b) equivalent to some determinate quantity of liquid, as a pint or half-pint, and this weight prevents the corresponding cup-shaped leaf or bucket of the wheel from turning over till it has received a quantity of the liquid just exceeding that weight. The number of times this operation takes place affords of course an exact measure of the quantity of liquid which passes through the wheel, and by deducting at any time the quantity remaining in the pyramidal case, B (which may be done by a pressure gauge, as before explained), from the quantity shown on the indicator, the remainder will be the quantity which has passed through the wheel and been withdrawn through the tap, H. But should it be desirable that the discharge should take place at a higher level than the bottom of the case, B, then, in order to force the liquid up to the higher

level through a pipe,—such, for example, as H′,—the air in the pyramidal case, B, must be condensed by successive discharges of liquid into it till it has acquired a degree of expansive force sufficient to produce the desired effect.

Claims.—First, I claim the apparatus for measuring and registering the flow of liquids, firstly before described, in the general arrangement, combination and adaptation of parts of which the same consists; that is to say, in so far as respects the self-acting modes or means, by which the measuring cylinders are freed from air—the rising and falling movements of the cylinder floats are transmitted to an oscillating beam unattached to the cylinders, and thence to a registering train of wheels—the supply and discharge passages are alternately opened and shut by an oscillating beam—and the float stalks are held down and liberated alternately—all as before described.

Second, I claim the apparatus secondly before described, in so far as regards the peculiar combination of means by which it both measures and registers the flow of liquids from vessels, and exhibits the money values of the quantities so measured and registered; and the application of so much of the said apparatus as relates to the money values to other liquid registering machines.

Third, I claim the apparatus thirdly before described, in so far as regards the combination of means by which the measuring and registering are effected by the turning merely of the tap handle; and I claim it both as constructed for measuring and registering the flow of solids in a running state, and with the additions and modifications necessary for its adaptation to liquids, as before explained.

Fourth, I claim the apparatus fourthly before described, in so far as regards the measuring of liquids withdrawn from vessels by the quantity of air admitted to supply their place, and the application to that purpose of air, which has been previously measured by an air-tight drum revolving in water (as to which itself I make no claim), or by any other suitable instrument, and registered by an indicator attached to such drum or other instrument.

And, *fifth*, I claim the pyramidal apparatus fifthly before described, in so far as regards the open wheel, C, the weighted close chamber, D, and the employment of compressed air to raise the measured and registered liquid, when required to be delivered at a high level. And I claim also the application generally of compressed air for the purpose aforesaid.

DESIDERATA IN A REPOSITORY FOR PUBLIC RECORDS.

In the review of Mr. Fergusson's publication, (*Mechanics' Magazine*, No. 1352,) it is remarked, that besides the incongruities and want of taste for which the new British Museum is remarkable, he has proved it to be "as defective, and as badly contrived for its purposes, as it well could be." Unfortunately similar observations are more or less applicable to most of our public buildings. So far as architectural appearance is concerned, that must principally depend on the taste of the employer—whether as selecting some particular architect, and depending solely on his taste, or whether in selecting one among several designs; but in regard to gross failures in the appropriateness of a building for its intended use, this has in most cases resulted from neglecting to have drawn up, previously to commencing the design, detailed indications of the several uses for which the intended structure was to be erected—of the various particulars requisite to its perfection in point of efficiency and economy—of the dangers to which it might be liable, and of the inconveniences to be avoided. It has already been noticed in this Journal, that Sir Samuel Bentham habitually drew up such indications for his own use, and further, that when in the year 1811, in conformity with the desire of the Admiralty, he designed a plan for the renovation of the Naval Arsenal at Sheerness, he perceived that the eligibility of the several parts of it, could not be judged of, without an exhibition of the several purposes he had kept in view in forming it. He accordingly drew up and sent to the Navy Board, preparatory to its being laid before their Lordships, the "Desiderata in a Naval Arsenal." Part of his letter which accompanied this paper, seems equally applicable to designs in general, as indicating the advantages likely to result from specifications of desiderata, and which he "flattered himself might be found of use in various ways."

"Should the study or experience of any one who may peruse them, suggest objects as desirable to be attained, other than those indicated by me—should it be observed, that on my part I have disregarded the indications I have myself furnished—it could not but tend to the perfection of the design

were such farther indications, or such observations, noted and communicated to me; should any of my indications appear incorrect or otherwise objectionable, or should the means I have proposed for effecting particular purposes seem inefficient, the noting observations of this nature could not but lead to discussion, and to the remedy of such defects. And farther, I may add, in a general point of view, that the bringing together and arranging indications of the nature of those in question, imperfect though the first attempt should be, seems the means best calculated, not only to assist the production of well arranged designs, but to enable those on whom the decision on them may depend, to bring each particular to a test, and to form a correct view and estimation of any design, general or partial, that may be offered for the improvement of any naval arsenal." And it may be added, of any other structure or intended accommodation.

In the instance of the new Palace at Westminster, had indications of the desiderata in such a pile been drawn up previously to forming the design for it, many of the causes of unlooked-for expense and subsequent discontent, would have been avoided. A sure foundation, natural or artificial, would have presented itself as a first essential, and thus would have been prevented the after thought, and an estimated expense, of the need for costly piling. It would have appeared amongst the desiderata that such a structure should be fire-proof—that it should be agreeably ventilated, warmed, and lighted—that no noisome sewers should run under it—that in chambers for debate, those acoustic principles should be attended to, by the observance of which even a weak voice may be rendered audible at remote distances. In this Palace the consequence of inattention to such desiderata in the first design, has been, that to remedy oversights, about double the sum of the first estimate has been expended, though no means have yet been found to improve audibility in the House of Lords, to do away the sewer, or to provide certain means of affording comfortable ventilation. Supposing the architect in drawing up the desiderata not to have been himself led to provide against such deficiencies in his first design—surely, with a statement of the several desiderata in their hands, some among the many who had first to give opinions on the design, would have noticed its imperfections as well in point of appropriateness for use, as of its omissions as influencing the estimates; or even, should in that stage of the business such particulars have continued to be disregarded, among the members of parliament who had to consider the subject, and vote the funds for the erection of their Palace, some would have been found, having the desiderata before them, to notice such manifest neglect of several of them; the design, the original estimate, would have been revised, and it would then have rested with parliament either to have the design contracted, or to vote the two millions at once for its execution; but it would not afterwards have been the cause of bickerings, debates, and regrets.

A Record Office has now to be provided. It is not too late for its design to be submitted to the test of a well drawn-up statement of the several particulars desirable in such a building. It happened that Sir Samuel Bentham devised the Record Rooms in Portsmouth, Plymouth, and Sheerness Dock Yards, and among his notes on the subject, there remain many that are applicable to a general repository for records; from these notes a few desiderata have been extracted and put together in the form of indications of the desiderata in a Repository for Public Records. This sketch pretends to nothing beyond drawing attention to the subject; it is but a skeleton of what such preliminary indications might be; but when publicity is given to it, masters of the subject may be tempted to supply its deficiencies, and if filled up and improved by abler hands, the result may be that at last one of our public buildings may, without after thought and palliatives, be constructed free from glaring faults.

Desiderata in a Repository for Public Records.

Looking to the safe keeping of Public Records, it appears that the greatest danger to which they are exposed is that of *conflagration*, and that on their being burnt the loss would be irreparable; the desiderata, therefore, that present themselves as of first importance are those tending to diminish chances of outbreak of fire, the limiting as far as pos-

sible the extent of its ravages, should it take place in any part of the building—and the provision of means for its speedy extinction in whatever part of the structure it might originate.

1. Hence, a Repository for Records should be an *isolated* building.

2. Fire-proof.

3. Its several chambers to have no opening one from the other.

4. No internal air funnels, such as staircases.

5. All interior fittings of non-combustible materials, and at the same time slow conductors of heat.

6. The apparatus for warming the interior, and for drying its atmosphere in damp weather, such as not to require fire within the building itself.

7. No artificial light within the structure. But, notwithstanding these precautions, should conflagration take place,

8. Provision of fire-extinguishing apparatuses, and that of a description such as to be of ready access, and of immediate application to each and every compartment of the structure, under the head of convenience of the structure for use, and the preservation of its contents from various deteriorating causes.

9. The situation of a Repository for Public Records should be of ready access to that description of persons who have the most frequent occasion to consult them.

10. Distant from noxious or damp vapours.

11. Such as to admit of future extension of the building.

12. On a foundation naturally dry, or at least made so artificially.

13. The walls of non-absorbent materials.

14. Internal arrangements, such as to afford means of due classification and arrangement of the records, of accommodation to persons permitted to consult them, of facilitating general cleanliness, of preservation of the records from moisture; from that degree of heat which is injurious to parchments or seals; from insects; from vapours destructive of ink; from pilferage; from damage by the careless or malicious; from external violence.

15. Provision for warming, drying, and ventilating the isolated receptacle, and for maintaining in it, when requisite, that degree of atmospheric humidity which is desirable for parchments. In the vicinity of the repository for records, but *not* connected with it,

16. Accommodation for a military guard.

17. Accommodation for civil police.

18. Arrangements for rendering the services of the military guard, and of the civil police, as effectual as possible, with a small number of persons employed.

19. Habitations for a resident keeper of the records, for his resident assistant, and for the necessary domestics.

20. Apparatus for warming, drying, cooling, ventilating the isolated repository, as also the detached building.

Without pretence to form a design for buildings conformable to the specified indications, the following suggestions of some of the means by which the desiderata might be obtained, may answer the purpose of showing, that they are not incompatible with economy, or with architectural precision, beauty and grandeur of external appearance; that examples exist where appropriate materials have been employed, as well as appropriate means of effecting the purposes desired.

It is not in such a rude sketch as this that any suitable site could be pointed out; but to begin with the foundation of a Repository for Records.

Isolation of the repository implies that no use should be made of any part of the structure, but for the safe keeping, and consultation of the records; consequently, as subterraneous chambers might be injurious to them, the foundation over and above the ordinary provision for its security, should be made solid to a sufficient depth, and up to a sufficient height, above the level of the surrounding area, to ensure the superstructure from immediate dampness of the ground; moreover, that ground damps might be guarded against, the whole area of the superstructure should have a sufficient thickness of hydraulic concrete grouted over it, in which a layer of slate should be imbedded.

The building would have two faces along its length for windows. Apartments 40 or 50 feet long, having windows at both ends, are abundantly light in the middle of the length; consequently, from 40 to 50 feet might be the length of the chambers, that length forming the width of the edifice: the dimensions of it in

the other direction would be determined by the space required for the deposition of the records, and the number of stories decided on; that number might perhaps at the first be confined to two or three, with a view to future additions in height, as the quantity of records might increase.

Amongst the most suitable materials for the walls, are the best description of well-burnt bricks; they are bad conductors of heat—are not injured by high degrees of it—are sufficiently impervious to moisture from external rains. The late building in Lincoln's Inn, affords an example of the harmonious effect in architecture, of a brick edifice with stone dressings.

In order that there might be no internal communication between the chambers, and that there might be no internal air-funnels, the chambers might be separated one from the other by continuous brick walls along their whole length transversely of the building; flat arches springing from those walls to form the ceilings of those chambers, and foundation for the floors above; windows at both ends of these chambers, and also a door at one end, opening to an external gallery, the access to which should be by an external staircase.

The beauty of that side of the edifice in which were these galleries, would depend on the tasteful composition of the design for them, and they would afford ample scope for the exercise of architectural genius. The other side of the structure would be open to the application of any of the ordinary rules of architecture, provided only, that the windows were large, for the admission of abundant light.

The frame of the external galleries, and of the staircase of metal, *iron*, as cheapest. The staircase and galleries, protected from the weather by glass opposite the windows of the chambers—in other parts by inclosures of iron, slate, or brick.

External shutters to all windows and glazed doors; the shutters of metal, framed in panels, as thin as possible, so as not to retain heat.

For internal fittings, no material seems so appropriate as slate; it is not costly, it admits of being wrought with a smooth surface for shelves, partitions, and other purposes; it is a bad conductor of heat; it does not harbour vermin, nor retain dust; is easily cleaned; when washed does not absorb moisture, therefore soon dries. These several good properties of slate, point it out as a superior material for the floors of the chambers also. Its efficiency and cleanliness, as paving, was proved long ago at the Ordnance premises at Plymouth, where, in one part, the natural slate rock having been smoothed on its surface, bore heavy traffic upon it, and was always remarkable for its cleanliness.

For the accommodation of visitors, a reading room on each floor, fitted up with appropriate desks, also of slate, and having a raised seat for an inspecting librarian, from whence might easily be seen all the desks, so that he might assure himself that no improper use was made of records, by persons to whom they might be entrusted for perusal.

For warming the interior of the repository—as it is said to have been ascertained that heated air is injurious to parchments—as open fire-places, besides extreme danger of conflagration from their use, are highly objectionable on account of the dirt and dust they cannot but occasion, and of the necessity of the frequent attendance of servants upon them,—the preferable mode of heating seems to be, by means of either hot water or steam conveyed and distributed in pipes to different parts of the structure—a mode in successful common use for many private habitations as well as plant conservatories. The apparatus for heating water for this purpose, not, of course, in the repository itself, but in a *detached* building, from which either water or steam might easily be conveyed at pleasure to any of the chambers of the repository.

For ventilation, an arrangement of the windows, or of a part of them, so as to throw the current of air on opening them to the ceiling, is, perhaps, the most agreeable mode in warm weather, due provision being made by suitable apertures for the exit of foul or heated air; but for the extraction of vitiated or damp air, when these means are not sufficient or advisable, no other seems so effectual as that devised by Dr. Hales a century ago, namely, the extraction of foul air by a simple machine, in fact, a kind of wooden air-pump. Upon occasions when the external air might be too cold or damp for admission by the windows, a

supply of fresh air might be dried and heated in the exterior water-heating room; that heated air might, by a hygrometer, be ascertained to be of that precise degree of dryness most proper for the conservation of either papers or parchments, in the same way that the degree of heat would be ascertained by the thermometer.

Among the most perfect arrangements for the guarding of any site, is that which was proposed by Sir Samuel Bentham for Portsmouth Dockyard. There being a space left clear from buildings along the outside of the whole boundary of the yard, he proposed that instead of placing guards inside the wall here and there, as there might happen to be vacancies free from buildings or incumbrances, sentinels should be stationed on the outside of the wall, one at each of the angles or prominences of it, so that every part of the boundary might be under the inspection of the guard. So, the repository being isolated, a sentinel stationed at each angle of it, would have a side of it and an end under his inspection and guard, and every side and end of the building would be under the inspection and guard of two separate sentinels; and, in fact, three of them would each be, as it were, a check upon and security for the vigilance of the others. There were other contrivances proposed for the prevention of depredation over the wall at Portsmouth, not necessary to be detailed on this occasion.

The building above spoken of as the place for the heating and ventilating apparatus would be part of a detached mass, affording apartments for a resident keeper and a resident sub-keeper of the records, for a housekeeper and a porter; an office for the superior keeper of the records; a military guard-house; a police station, and all the apparatus for extinguishing fire and supplying water.

It seems almost superfluous to remark that the speedy extinction of fire depends mainly on the *prompt* supply of water to be thrown upon it; but this fact would materially influence the design for the detached building, since it would be desirable that it should be carried to a considerable height for the purpose of obtaining an elevated water cistern over its top. It is on this consideration, that some such arrangement as the following is suggested:

The basement story of the building to contain all the heating, ventilating, and fire-extinguishing apparatus, as also a store for coals, and for other ordinary purposes of cellarage. On the ground floor, guard rooms, lodgment for the guard when not on duty, and the requisites for a police station. On the floor next above, offices for the superior non-resident keepers of the records and for clerks and assistants. Above the offices, a suite of apartments for the resident keeper; next above, a residence for the assistant resident keeper. The uppermost story might afford lodgings for a housekeeper and her housemaids for cleaning the repository. The whole to be then surmounted by a capacious reservoir of water.

The fire-extinguishing apparatus, supposing it to be quite complete and independent, to consist in the first place of a deep well, capable of furnishing a large supply of water. 2ndly. A steam engine and force-pump, to pump up that water for use in the several parts of the detached building, to keep the great reservoir constantly full; and in case of fire, to force water against and over the repository, its dependent building, and the buildings in its near neighbourhood, should there be any such. With the view of keeping the engine in readiness for instant use, in case of fire, it would be, desirable that it should be constantly employed, and this possibly it might be, in supplying houses in the vicinity with water, at a rate which should just cover the expenses of raising and distributing it. 3rdly. A reservoir to contain at least 300 tons of water, at a height sufficient, as it would be on the top of the detached building, to throw a jet of water on the repository. 4thly. A series of pipes, connected with the reservoir and the force-pump, laid along the sides and ends of the repository, and along the side of the detached building—those pipes of sufficient diameter to convey water as fast as it could be raised by the engine, and having upon them at different places, provision for screwing on hose and jets. The high reservoir would, on the outbreak of fire, give water with a head sufficient to throw a stream upon the buildings, and before that source of supply could be expended, the steam-engine would be at work to force water from the well into the pipes,

and thence over the repository itself, the building subservient to it, as also to any other structures in the vicinity near which suitable pipes had been provided. In London, a still more profuse quantity of water might easily be added to the supply from the well; by connecting with the steam-engine the adjacent mains of the water company supplying the district. 5thly. A small pipe carried into every chamber of the repository, with means of affixing a hose, or drawing water in buckets, so that water might be instantly thrown on fire the moment of its outbreak.

This proposed system of fire-extinguishing and waterworks is the same, though on a more contracted scale, as that introduced in several of the royal dockyards, as devised by Sir Samuel Bentham. Its efficiency has been put often to the test of actual service, and always with marked success.

It may be said, that supposing entrance to the Repository of Records to be prohibited but by daylight, and supposing no fire or artificial light to be allowed within the building, conflagration could hardly be apprehended in it, excepting from spontaneous inflammation of its contents, or from lightning; yet considering the inestimable value of some of the records, none of these precautions can be looked upon as superfluous; and should it not be possible to completely isolate the structure, they would all of them be imperative.

Supposing for the moment that it might be necessary to consult records after dark, in this case, instead of permitting any artificial light within the building, illumination of it might be obtained from an exterior gas-light placed opposite a window, the whole of the illuminating rays being thrown into the opposite chamber by reflectors.

It seems needless to enter into a specification of minor arrangements that might advantageously be introduced, such as mechanical means of shutting at once all the shutters and external doors of a whole range of them, and of securing their fastenings under one single lock, so that it might not be too onerous a duty for one of the resident keepers to turn and keep the key of it himself; such also, as means of easily impregnating the air of the chambers with vapours, as the essential oil of turpentine, for the destruction of insects without injury to parchment, papers, seals, or ink.

In regard to the detached sudsidiary structure, it may be added in words of the 25th article of the "Desiderata in a Naval Arsenal," that the apartments for the resident officers "should in size, fittings, and general accommodation, be suited to the *income*, as well as rank of the several officers for whom they may be respectively destined." Inattention to this desideratum has often proved of as great annoyance to the officer, as it has been the cause of needless expense to Government; for instance, giving a coach-house and stables even to the high grade of assistant to a master-shipwright in a royal dock; his salary but 400*l.* a-year without addition by perquisites. An equipage cannot be kept upon any such income, but provision being made for carriage and horses naturally excites a longing for them. Often, the costly magnificence of Government houses, occasions their residents as much expense as would be to them the rent of a habitation suitable for their *income;* large and splendid apartments require more in quantity of furniture, and of a more costly kind than would be proper for an appropriate house; more fuel is needed to warm a large room than one of moderate size; more servants to keep a large than a small house clean; and so on. In the article in this Journal before quoted, it is shown that the houses for officers at the British Museum have cost "between 11,000*l.* and 12,000*l.* a-piece." Reckoning but eight per cent. on this capital sunk—little enough where all repairs, &c., are paid by the public as the landlord—the rent of each house is no less than 900*l.* a-year! Is that commensurate with the salaries of the occupants? To touch upon points that really should be considered in planning houses for officers of various ranks, article 26 of Sir Samuel's "Desiderata" says they "should be fire-proof, well ventilated, and abundantly supplied with water; they should be furnished with the best means of insuring cleanliness and comfort to the inhabitants."

The rendering houses fire-proof may, at first sight, appear a costly measure, especially if the great sum be referred to that has been expended for this purpose at the palace in Westminster; but,

on the contrary, had this desideratum been adverted to and provided for at first, it might have been productive of considerable saving. Amongst Sir Samuel's last designs as a commissioner of the Navy, was that in January, 1813, for a large storehouse at the Victualling Wharf, Deptford; this building had been proposed to be built in the usual way, when he recommended that it should be constructed fire-proof, and it was proved that the estimate for its erection in his manner was considerably less than the estimate for that proposed to be of inflammable materials. The proposed pile for offices, apartments, &c., though detached from the repository, might consequently, without hesitation, be made fire-proof. As to ventilation, though it be a subject that has excited the attention of so great a number of both scientific and practical men, the fact is, that little has yet been effected for the obtainment of due ventilation in ordinary habitations; yet were two or three of the leading principles on which it depends adverted to, it might be effected by simple means at all times, combining with it agreeable means for warming a house in cold weather, and cooling it in hot, at pleasure. Water would, of course, be supplied in abundance from the great reservoir—means of cleanliness, though proper to be detailed in the design for such a building, it is needless to enter into here. But as to those of comfort, they may possibly be deemed incompatible with an arrangement which provides for the lodging of so many persons, and of such various descriptions, under the same roof; but there are easy means of obviating the objections that may be made to it.

On the continent, as in the old style of buildings in Edinburgh, where the lodgings of a family are comprised in a single floor, however spacious that may be, the great source of discomfort arises from there being but one common stair leading to all the several apartments on different floors. In the suggested structure, the entrances to the guard rooms, and police office would be from the outside, a separate door for each; the several offices would have also their separate door and entrance-hall leading to a stair-case common to them all; as also to the upper floor,—for persons of the description of those who would have lodging there have rarely been accustomed to separate houses, besides that the order and cleanliness of the staircase would depend on themselves. But, the resident keeper and his assistant may well be supposed accustomed to the comfort of each a house to himself, with its cleanly entrance and stairs; the suites of apartments for these officers should therefore be provided with each its separate entrance door and staircase—they being of the description and width usual in moderate-sized houses. Noise from above or below is another source of discomfort, where several floors are occupied by as many families as floors; this is prevented in well-built houses abroad, and might easily be so here, by a suitable construction of floors and ceilings. Another consideration is that of saving labour to servants in such services as bringing up fuel from cellars; a *lift* would obviate inconveniences of this kind, and the steam engine might at some certain hour of the day be permitted to lend its aid. Were what may be deemed trifles such as these, but which really influence domestic comfort in no small degree, attended to, and provided for in the first design, a family of superior station and habits, would soon perceive the convenience and agreeableness of being lodged on a single, but an amply spacious floor.

It may be remarked, that the chief aim of this long article is to inculcate the expediency of drawing up the desiderata in any great work, previously to commencing a design for it; and it may naturally be asked, what was the result of those indicating the needful in a naval arsenal? No use was made of them. The Admiralty of that day having had more confidence in a private civil engineer than in their officer, did not even take into consideration the plan devised for Sheerness in conformity to those indications; but their Lordships appointed a Committee to report on some other plans which had been proposed for the dock-yard there. The instructions given to those gentlemen debarred them from taking Sir Samuel's plan into their consideration, and his office was soon after abolished. His mode of constructing a sea-wall at Sheerness, compared with other modes in point of expense, as also proof of the stability of that mode, appear in the *Mechanics' Magazine*, Sept. 16, 1848.

Notwithstanding the immense sum which has been expended at Sheerness, it is said that very many important desiderata have been neglected, besides that in lesser matters appropriateness has been disregarded. The houses for officers of inferior grades, for instance, are some of them the lesser halves of houses of a general design; these half houses, though so small, are said to have coach-houses and stables attached to them. One at least of the officers inhabiting these small residences, has however had the good sense, and interest sufficient, to obtain the conversion of his coach-house into a much-needed servant's bedroom.

Sir Samuel had taken means, as he thought, to obtain consideration of what really is desirable, and what superfluous, in a naval arsenal. He caused his Desiderata, with the letter that accompanied the paper, to be printed at his own expense; to each of his colleagues at the Navy Board he gave a copy of this pamphlet, interleaved with blank paper ready for their observations. When any great public building is in contemplation, would it be amiss to take a hint from that example? Might it not be productive of much good were the observations of persons, supposed to be the most conversant on the subject in question, to be so collected? By such means, instead of leaving room for such animadversions as those of Mr. Fergusson, there would be obtained before the commencement of a structure, so much practical and scientific information, as would doubtless leave little need for alterations whilst the work might be in progress, or room for after criticisms.

M. S. B.

MR. BARRY AND HIS REMUNERATION FOR THE PALACE OF WESTMINSTER.

We may be very well excused for stepping a little out of our way to touch upon matters which we are not exactly called on to notice, when we find that those to whose jurisdiction they properly belong, pass them over in silence,—although they make no scruple of frequently taking up others that do not at all concern them, and cannot have the slightest interest at all for their readers. If we exceeded our proper duty in speaking of Mr. Fergusson's "Observations on the British Museum," the *Builder* has fallen as much short of its duty in regard to that production, not having uttered a syllable about it, except to acknowledge having received a copy of it!—which is, no doubt, as singularly encouraging to others to endeavour to instruct the public by discussing architectural questions and opinions, as it is flattering to Mr. Fergusson himself.

After this *quasi* apology for ourselves, we proceed at once to remark that whatever be the result of "Mr. Barry's case," as far as he himself is concerned, it is likely to have one good effect, by leading to inquiry into the present system of architectural practice and remuneration. Our own opinion has been already expressed (page 11) briefly, but not inconsiderately; indeed, the more we consider it, the more objectionable does such system of remuneration appear to be. The principle on which it is founded is unsound, if not preposterous, inasmuch as it places the architect's interest at direct variance with that of his employer. Although nominally the same, the principle is altogether the opposite of that of ordinary commission in affairs of business and trade; for in them it is equally to the interest of employer and *employé* that the latter should have to receive a large amount of per centage. There, "the more the merrier," holds equally good for both parties; whereas, in architectural commission, it is precisely the reverse; for the more the architect goes beyond his first estimate, the better is it for him, and the worse for his employer. Where the difference between estimate and actual cost is but trifling—under five per cent.—it may be overlooked, as no more than ought to have been *looked for*, as a *contingency;* but when it amounts to cent. per cent. and upwards, it becomes quite a different, and a very serious matter—for it amounts to something not far short of actual fraud,—an ugly word, it must be allowed, but in itself a very *honest* one.

Were cases of excess beyond estimate, merely rare and exceptional ones, less could be said against the present system and its working; but, unfortunately for employers and the public, such cases seem to have become almost the rule. We have heard of one in the profession, who is in the practice of taking in his employers most shamefully, giving estimates which he himself must very well

know, by his own practice and experience, could not possibly be adhered to. In one instance—not a solitary one with him—he erected a house or mansion for a gentleman, which cost nearly three times as much as, according to his estimates, his employer calculated upon having to expend. No wonder, therefore, that prudent persons are exceedingly shy of having—if not actually forced to it—anything to do with "bricks and mortar," being aware that they know not where they may end if once they begin. What is to be wondered at is, that the public, viz., employers, should tamely submit to be imposed upon after that fashion, without making either effectual remonstrance or public exposure of facts. Still, such tame acquiescence may be accounted for, by the natural reluctance of individuals to come forward on such occasions *pro bono publico*, they themselves being the parties mainly interested; more especially as it would be very much like showing how egregiously they had been duped with their eyes open,—at all events, when it behoved them to have them open, and pretty widely, too.

Let us, then, thank Mr. Barry and the "Palace of Westminster" for opening our eyes to the prodigious difference between cost, as promised by estimate, and that occasioned by actual performance. To the nation, the cost of the building has been more than double what Mr. Barry himself had at first, either very carefully, or else very carelessly, calculated upon. Yet, instead of expressing any feeling of shame that such is the case, he now claims to be remunerated for having occasioned an expenditure of the public money, to double the amount at first contemplated! By "acceding conditionally," as he terms it, to the proposition of his being paid 25,000*l.* as the full remuneration for his labours—all that he was to expect—Mr. Barry, as it appears to us, acquiesced in, and made that his bargain. Instead, however, of so doing, he now comes forward and claims a most unprecedented amount of remuneration for a single work,—much more than many other highly-talented artists have made by the labours of their whole career and an entire lifetime. Among other matters, he lays great stress upon "variety of design" and "elaboration of details," whereas it appears to us that there is great monotony of design, and that the details are merely borrowed—no doubt judiciously, and from the very best examples of the style—still merely borrowed, and with very little, if anything at all, to show original design and invention. In comparison with the actual quantity of work and multiplicity of details, a few working drawings must have sufficed for the whole of the exterior as far as it is executed; because those which served as the pattern for one window, pinnacle, &c., served for all the rest, which are precisely similar in design. Granting, too, that extraordinary attention has been paid to "elaboration of details," that is rather matter for regret than for satisfaction, since, what with such elaboration, and the multiplicity of details also, a great deal of money has been expended which might just as well have been saved, or perhaps even better; for there is now an immensity of work which has been very ill bestowed, since, so far from conducing to grandeur or aiding general effect, it rather tends to produce fritter and finicality, and destroy breadth and repose. An over-seasoned dish does not say much for the skill of a cook, and, in our opinion, Mr. Barry has overseasoned his building, peppering it all over with carving in the most unsparing manner, so that it is not only florid, but fulsome. We admit that Mr. Barry's detail is irreproachable—frequently exquisite—but he is apt to bestow undue attention upon it, because too exclusively and without sufficient attention to other equally important matters of design. Satisfied with the appearance of his river front in his own drawings, he does not seem to have asked himself how it would show, in a building so peculiarly and unfortunately situated. Not the least unfortunate circumstance attending that front is its aspect, it being, except quite early in the morning, always in shadow, whereas it requires to have strong sunshine upon it, to bring out those minute touches of detail which are now lost, or else only serve to occasion a general appearance of confusedness. To enable us to see that front properly, there ought to be a floating platform stationed opposite to it in the river. To suppose, that Mr. Barry was not aware that he was lavishing an abundance of minute ornament where it would produce no effect—none, at least, at all adequate to its labour

and cost—would be very much like accusing him of a want of requisite foresight. The positive disadvantageousness of situation, neither he nor any one else could overcome, but he might have *humoured* it. He should have accommodated his design to the requirements of the special case. At all events, he might easily have exercised greater economy, both artistic and pecuniary: yet, although his original design for the river front would very well have borne to be sobered down, and some of its ornament pruned away, he has since gone greatly beyond the degree of decoration he at first contemplated, notwithstanding that the river embankment and foundations had proved far more expensive than had been calculated. No wonder, then, that the cost has already swelled to an amount which quite startles the public: let us hope that it will have been startled to some purpose. Great delay, too, as well as enormous cost has been occasioned by that "elaboration of detail" on which Mr. Barry seems to plume himself, and in which he, no doubt, finds a gratification that must go far towards rewarding him for his labours. But for a vast deal of thrown-away elaboration, the same time and the same money would have sufficed to complete the edifice; whereas now a pause has come, and none of the present, if any of the next generation, are likely to behold it finished. With the exception of the Royal Porch and lower part of the Victoria Tower, everything has yet to be done on that side (the west) which is most of all exposed to view, and where such decorations as Mr. Barry delights in could be satisfactorily seen.

In urging his claims to be paid according to the usual rate of commission, Mr. Barry, of course, says nothing as to the fallaciousness of his original estimate; but he talks of sacrifices on his part, and hints that he has been forced to give up a great deal of other practice. No doubt; the only wonder is, that if his labours at the Palace of Westminster have been anything like what he represents them to have been, he should have been able to attend to any other practice at all,—to undertake the New Treasury Buildings and Bridgwater House, neither of which, perhaps, he might have had, had he not been employed on the Westminster edifice. It must have been evident, both to himself and every one else—evident, in fact, to plain common sense—that a work of such magnitude would leave him very little leisure for other occupation. Since he chooses to look at the matter in a very prosaic—some would call it mercenary—light, it was for Mr. Barry to consider what he would have to give up as well as what he would get. We will, just for a moment, suppose that he might have made not only as much, but a very great deal more, by his other practice, had he not engaged in the Houses of Parliament: all we have to say is, that if such be really the case, and money be his main object, he should have chosen differently, and have stuck to the substance, and have left the empty shadow, fame, to others.

"Give fame to fools, to have it and to hold;
For what is fame compared with solid gold?"

For our part, we think that Mr. Barry's claim for more than the 25,000*l.*, which he was plainly given to understand would be the *ultimatum* of his remuneration, should be either withdrawn or firmly resisted. There is already, far too much of low mercenary feeling and spirit in the architectural profession, and, indeed, among our artists generally,—a spirit that requires to be checked rather than at all encouraged. Let the traffickers and money-changers be driven out of the Temple of Art.—Let those whose chief, if not sole object, is money-getting, betake themselves elsewhere,—to those callings where much larger incomes may be made than can be derived from a Palace of Westminster.—Does Charles Barry envy George Hudson?

LAW OF PATENTS.—REPORT OF THE COMMITTEE ON THE SIGNET AND PRIVY SEAL OFFICES.

We, the Committee appointed, in pursuance of your Lordship's Minute of 23rd June, 1848, to inquire into the circumstances connected with the offices of the Clerks of the Signet and of the Lord Privy Seal, having maturely deliberated upon the several matters comprised within the limits of our inquiry, have agreed to the following Report, which we beg leave to submit for your lordship's consideration.

We have examined the several witnesses whose evidence will be found appended to this Report.

In the case of patents for new inventions, which has formed a large branch of our

inquiry, it will be seen that we have had before us persons whose interests are variously affected by the mode of passing patents; and we have not failed to pay the greatest attention to the statements and opinions adduced by those several parties.

We have referred to the Report of the Committee appointed by the Board of Treasury in 1836, to inquire into the fees and emoluments of public offices.

We have also made frequent reference to the evidence taken before the Committee of the House of Commons in 1829, on the law relating to patents for inventions.

Mr. Hindmarch's work on patents has afforded valuable assistance to us in the course of our labours, and we have largely availed ourselves of it in describing the history of patents for inventions.

We have also referred to the publications of Mr. Webster, Mr. Carpmael, and other writers, as affording authentic information in regard to the process of granting patents of invention.

The Act of 27 Henry VIII., c. 11, regulates the passing of instruments through the offices of the Signet of the Privy Seal.

The preamble of that Act states that, "Whereas the King's Clerks of His Grace's Signet and Privy Seal, giving their daily attendance for the passing and writing of His Majesty's great and weighty affairs, &c., having for their entertainment and their clerks no fees or wages certain for those offices other than such fees as cometh and groweth of the said Signet and Privy Seal, to the intent that from henceforth they should not by any manner of means be defeated of any part or portion of the same their fees, Be it therefore ordained," &c. The Act then proceeds to ordain that all grants of the King to be passed under any of the Great Seals of England, Ireland, &c., shall be first brought "to the King's Principal Secretary, or to one of the Clerks of His Grace's Signet, to be at the said office of the Signet passed accordingly." And that "one of the Clerks of the said Signet" shall issue his warrant, subscribed with his hand and sealed with the King's Signet, to the Lord Keeper of the Privy Seal, who is thereupon to issue his warrant in like manner to the Lord Chancellor, &c.

The Signet Office is a branch of the Secretariat, and equally pertains to all the departments of the Secretaries of State, though the chief business is transacted through the Home Office.

From a very early period the Secretary of State was Keeper of the King's Signet, and had under his direction four Clerks of the Signet. These clerks were appointed by patent for life, and were allowed to perform their duties by deputy.

The act of 57 Geo. III., c. 63, directed that all officers appointed after the passing of that act should perform their duties in person, and at fixed salaries; and that the fees belonging to officers so appointed should be carried to the account of the Consolidated Fund.

By the act of 2 Wm. IV., c. 49, the Lords of the Treasury were authorized to abolish any of the offices of the Clerks of the Signet and Privy Seal, as vacancies should arise. Under this authority two of the four Clerks of the Signet have been abolished.

The establishment of the Signet Office at present consists of—

One Clerk of the Signet, appointed by patent for life.

One Clerk, appointed by patent during pleasure.

A deputy Clerk of the Signet, and

Two Record Keepers and Receivers of Fees.

Mr. Bentinck, the first Clerk of the Signet, was appointed in the year 1801, from which time it appears that he has never attended at the office or performed any duties, the terms of his patent permitting him to appoint a deputy, by whom he acts entirely.

Mr. S. C. Grey, the other Clerk of the Signet, was appointed in the year 1847. He is obliged to perform his duties in person, and is paid by a fixed salary. His duties consist in attending at the Signet office to sign the various documents.

The deputy Clerk of the Signet, who acts for Mr. Bentinck, is Mr. Plasket. His duties are the same as those of Mr. Grey, in addition to which he audits the annual acount of the Signet Office.

The Clerks of the Signet give their attendance during alternate months.

The Record Keepers and Receivers of Fees are Mr. E. D. Jones and Mr. H. W. Saunders. Their duties are to prepare the whole of the documents which pass through the office, to collect and account for the fees, and, in fact, to carry on the general business of the office.

In consequence of the indisposition of Mr. Jones, these duties have been for some time past performed by Mr. Saunders alone, with the occasional assistance of an extra clerk.

We annex, in the Appendix, a statement showing the amount of fees and emoluments received by the several officers of the establishment in the years 1845, 1846, and 1847.

We also annex an account of the surplus fees paid over to the Consolidated Fund in the same period.

The Keeper of the Privy Seal has always been one of the great officers of state.

From the time of Henry VI. the affixing of the Privy Seal appears to have been considered as the warrant for the legality and propriety of grants from the Crown; and to have constituted the authority to the Lord High Chancellor for affixing the Great Seal to such grants.

The establishment of the office of the Privy Seal, which has been revised under the authority of the Acts 57 Geo. III., c. 63, and 2 Will. IV., c. 49, is composed as follows, viz.:

	Salary.
Lord Privy Seal	£2000
Private Secretary	150
First Patent Clerk (Mr. Donne)	300
Second Patent Clerk (Mr. Eden)	300
Record Keeper and Receiver of Fees (Mr. Eden)	200
Junior Clerk (Mr. Goodwin)	200
Messenger	70
Housekeeper	30
With an additional allowance from Signet-office of	20

In addition to his salary as Patent Clerk and Record Keeper, &c., Mr. Eden enjoys apartments in the official house, with an allowance of coals and candles.

Mr. Goodwin states that he receives extra pay for attendance after office-hours, at the rate of 2s. an hour, which he estimates as amounting to about 20*l.* a year. The office hours are from 10 till 3 o'clock.

He also states that he receives occasional gratuities from individuals desirous of expediting their patents, for his extra exertions, which he considers as amounting to 70*l.* or 80*l.* a year.

The attendance of Mr. Donne and Mr. Eden, as patent clerks, is during alternate months. As Record Keeper and Receiver of Fees, the latter is in daily attendance throughout the year.

During their months of attendance the patent clerks attend at the office every day, but it does not appear that the amount of business they are called upon to perform occupies, on an average, more than an hour a day.

Their duty consists in examining the Privy Seal bills and signing them.

Mr. Eden, as Record Keeper, has the custody of the records, and it is his duty to see that they are properly examined and deposited.

As Receiver of Fees he pays over to the Consolidated Fund, at the end of every quarter, the amount of surplus fees, after paying the salaries and other expenses of the establishment.

The main business of the office of the Lord Privy Seal appears to devolve on Mr. Goodwin, the junior clerk, who has to prepare the bills and other instruments, and assist in the other duties of the office.

The annexed account will show the amount of the expenses of the Privy Seal Office in each of the three years 1845, 1846, and 1847, and of the surplus fees paid to the Consolidated Fund in the same period.

The chief business transacted in the offices of the Signet and Privy Seal is that connected with the passing of Letters Patent, or, as they are commonly called, Patents.

Letters Patent, that is, open letters, *literæ patentes*, are so called, because they are not sealed up, but exposed to open view, with the Great Seal pendant at the bottom, and are usually directed or addressed by the King to all his subjects at large, and the patent-rolls, on which they are recorded, are open for public inspection.

There are two principal classes of Letters Patent, one for the grant of appointments to offices under the Crown, the other for granting to inventors the sole use of their inventions.

The other miscellaneous descriptions of Letters Patent are,

Charters.
Denizations.
Pensions.
Creations of Honours.
Special Pardons.
Licenses, in Mortmain, and for Trinity House Lights, &c.

But as they go through the same forms as the former class of patents they may be described under the same head.

The process of passing patents of appointments to offices is as follows:—

1. The first Lord of the Treasury, one of her Majesty's principal Secretaries of State, or other minister, whose proper duty it may be, takes the Queen's pleasure in regard to the appointment of a particular individual to an office, and then directs the preparation of the necessary instruments for carrying the appointment into effect.

2. A sign manual warrant (*i. e.*, a warrant signed by her Majesty's own hand) is accordingly prepared, addressed to the Attorney or Solicitor-general, directing him to prepare a bill for her Majesty's signature.

3. The bill is prepared in the Patent Bill Office of the Attorney and Solicitor-general, according to a prescribed form, and submitted by the Secretary of State for her Majesty's signature. Two transcripts of this bill are at the same time prepared in the Patent Bill Office, one of which is sent to the Signet Office, and eventually becomes the Signet Bill; the other to the Privy Seal Office, to be aftewards made the Privy Seal bill.

4. The bill, when it has been signed by

the Queen, is called the Queen's bill, and handed over to the Signet Office, where the Signet bill is prepared, by appending to the transcript sent there from the Patent Bill Office a proper heading and conclusion. The Clerk of the Signet, or deputy clerk, then signs the bill, and having procured the signet to be affixed to it at one of the Secretary of State's offices, transmits it to the Lord Privy Seal. The Queen's bill is filed as a record in the Signet Office.

5. The Privy Seal bill is prepared in the same manner as the Signet bill, and the Privy Seal having been affixed to it by the Lord Privy Seal, it is forwarded to

6. The proper officer of the Lord Chancellor, when the patent is engrossed on parchment, and the Great Seal affixed.

It will be seen by a reference to the evidence of Mr. Goodwin, that in certain cases patents pass to the Great Seal by what is called "immediate warrant."

In those cases the Queen's bill is signed by a Clerk of the Signet and a Clerk of the Privy Seal, without having the seals attached; an order is endorsed on the back of the bill, and signed by the Queen, directing that the patent pass by immediate warrant. That order is considered equivalent to a writ of Privy Seal. The occasions on which it is used are not frequent.

If the instrument be an appointment to an office involving the payment of a salary, two dockets also are prepared in the Privy Seal Office, one addressed to the Lord Privy Seal himself, the other to the Lord Chancellor, and transmitted to the Treasury. These dockets state the nature of the bill which the Lord Privy Seal has been directed to prepare; and an acknowledgment, signed by three of the Lords Commissioners, is apppended to them at the Treasury, stating that their Lordships have been made acquainted with their contents. The one addressed to the Lord Privy Seal is returned to that officer, when he proceeds with the Privy Seal bill. The other is forwarded to the Lord Chancellor.

The process of passing patents of invention will be described in a subsequent part of this Report. As that class of instruments is quite different in its character and objects from the patents for appointments, and requires to be differently dealt with, it will be convenient first to conclude this branch of the subject.

Patents of appointments to offices may be arranged under two heads :—

Offices held during pleasure, and

Offices held during life or good behaviour.

We consider that, for the former class of appointments, a sign manual warrant, prepared according to a prescribed form, would in all cases be amply sufficient; and that the inconvenience arising, both to the public and to individuals, from the delay and expense incident to the present mode of making grants of office by patent, might be avoided without detriment to the public service.

We would also suggest that, in the event of a vacancy occurring amongst the members of a board, it would be sufficient for the warrant to name the individual by whom the vacancy is to be supplied, without the necessity of reconstituting the entire board, which is the practice now in some cases.

For the latter class of appointments, those during life or good behaviour, we think it may be advisable still to retain the form of appointment by patent. But even in these cases it appears to us that the process of passing the letters patent might be simplified with great advantage.

No necessity can exist for a reference, in every case of a fresh appointment, to the Attorney and Solicitor-General. When a form of appointment has once been settled by competent legal authorities, so as to leave nothing to the discretion of the department beyond the insertion of the proper names, dates, &c., in the blank places, the Privy Seal might at once be affixed to the original document prepared in the department from which the appointment emanates. This would be sufficient authority to the Lord Chancellor for causing the patent to be engrossed, and for affixing the Great Seal to it; it would likewise render unnecessary the bill and transcripts which are now prepared in the Patent Bill Office of the Attorney and Solicitor-General, and which form the instruments called the Queen's bill, the Signet bill, and the Privy Seal bill.

The dockets now prepared at the Privy Seal Office, when a salary is mentioned in the bill, might also be dispensed with. The salary of every officer under the Crown is regulated by competent authority; these dockets, therefore, are a mere formality, which there appears to be no reason for retaining.

Ecclesiastical appointments differ in some respects from other patents of appointment, inasmuch as the warrant, authorising the preparation of the Queen's bill, is directed to the Clerk of the Signet attending, instead of to the Attorney or Solicitor-General, and the Queen's bill is prepared in the Signet Office as well as subsequently the Signet bill.*

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* This does not apply to the bishopric of Sodor and Man.

In the case of Colonial Bishopricks it has been, of late years, the practice to direct the warrant, authorizing the preparation of the Queen's bill, to the Queen's Advocate.

We recommend in these cases, and also in the cases of charters, and the other descriptions of letters patent before enumerated, that when Her Majesty's pleasure has been taken, the Queen's bill should be prepared at once in the office of the Secretary of State, and then go through the same process as ordinary patents of appointment to office.

In addition to the above-mentioned instruments, certain documents connected with the appointment of Archbishops and Bishops are prepared in the Signet Office. A few warrants appointing almsmen are likewise made out there, and the Queen's letters addressed to the Lord Lieutenant of Ireland are entered in the Signet Office, and sealed with the Signet, and signed by one of the clerks of the Signet. The preparation of these several instruments appears to us to be a duty attaching more properly to the office of the Secretary of State for the Home Department; and we are of opinion that the intervention of the Signet Office should, in all these cases, be dispensed with.

The Treasury Minute constituting our Committee directs our attention only to the practice of the Signet and Privy Seal Offices. But in considering the subject of passing letters patent through those offices, it was very difficult, if not impossible, to exclude altogether from consideration the other stages through which they had to pass, inasmuch as the several successive stages are intimately connected with each other, and form links in a continuous chain; and in deciding upon the expediency of reforming any office, whose functions are connected with those of other offices, it is necessary to see what the functions of those offices are, before any decision can be safely made.

In the evidence, therefore, annexed to this Report, it will be found that we have extended our inquiry into the general process of passing patents of invention, and though we do not desire to exceed the limits of the duty with with which we are entrusted, we think it right to offer some general observations on the subject.

(To be continued in our next.)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 26TH OF JULY, 1849.

WILLIAM BOGGETT, of St. Martin's-lane, Middlesex, manufacturer. *For improvements in methods and machinery for obtaining and applying motive power.* Patent dated January 20, 1849.

1. Mr. Boggett describes and claims two several arrangements for propelling vessels by means of paddles, whereby the paddles are made to enter the water in an angular position, and to act during the most influential part of each revolution, horizontally or in the direct line of the vessel's motion, and whereby also, the paddles are made to act altogether, or two, three, or more of them, at one and the same time, with the greatest useful effect of which each is capable. Of these arrangements we shall take an early opportunity of giving a full description, with engravings.

2. A method is also described and claimed of restoring to compressed air, when employed as a motive power, the heat of which it has been deprived by such compression, and thereby increasing its expansive force. Mr. Boggett applies to this purpose the heat generated by the slacking of lime with water, or by the mixture of concentrated sulphuric acid with water, or simply that which is evolved from hot water; the compressed air being passed through a cylinder, inside of, or concentric with, one containing the reheating element.

HENRY NEEDHAM, of Vine-street, Piccadilly, gun-maker. *For certain improvements in fire-arms.* Patent dated January 20, 1849.

Mr. Needham claims—

1. The combination in fire-arms, of a hammer with a percussion cap charger in such manner, that every time the hammer is drawn back to full cock, the charger moves forward, and puts a percussion cap upon the nipple.

2. The forming of a channel in the fore part of the stock, for holding percussion caps, having rectangular openings and guide pins, to prevent the caps from entering in any other than the right direction. And,

3. A peculiar safety lock.

We shall give, in an early number, a full description, with engravings, of these improvements.

REES REECE, of London, chemist, *For improvements in heating peat, and obtaining products therefrom.* Patent dated January 23, 1849.

The combustion of the peat is to be effected by means of a blast of cold or of heated air, and the products of combustion are to be made to pass through a hydraulic main and a series of condensing pipes.

A deposit is left in the condensing pipes used in the above process, from which "paraffine," both in a solid and liquid state, is obtained by distillation. The solid portion is then subjected to stearine presses, by which an additional quantity of liquid paraf-

fine is obtained. The solid is capable of being moulded into candles, and the liquid is used as an inflammable oil for lamps.

Claims.—1. The above process for treating peat, instead of distillation.

2. The means of treating and purifying paraffine.

Edward Slaughter, of the Avonside Iron Works, Bristol, engineer. *For improvements in marine steam engines.* Patent dated January 23, 1849.

The following improvements are embodied and claimed in the specification of this patent:—

1. Connecting two or more cylinders to the propelling shafts of marine engines, for the purpose of propelling, and combining therewith an engine or engines to work the air pumps and condensing apparatus.

2. Connecting more than three cylinders to the propeller shaft. The patentee proposes using as many as eight small, instead of two large cylinders, and having four cranks upon the propeller shaft.

3. Connecting two cylinders to one steam chest or slide-valve casing.

4. Employing annular air pumps with annular pistons, and sometimes using the internal portion of the annular portion as an air pump, &c.

5. Arranging the air pumps so that they may make more strokes than the steam cylinder.

6. Employing, in conjunction with an auxiliary steam engine (for a sailing vessel), a small engine to work the screw propeller, just at the velocity which will not impede the motion of the vessel when under sail, leaving the larger engine unemployed. For this purpose, it is calculated that a six-horse engine would move the propeller where a power of 200-horses was employed in propelling the vessel.

Charles De Bergue, of Arthur-street West, London, engineer. *For improvements in steam-engines, in pumps, and in springs, for railway and other purposes.* Patent dated January 23, 1849.

The first of these improvements consists in connecting the piston of beam engines to the beam without the intervention of a parallel motion. This is effected by directly attaching the beam to the piston by means of a knuckle joint, the connecting-rod working inside of a hollow piston-rod.

A second improvement relates to pumps. The pump bucket instead of being made tight in the barrel by means of packing, is connected to the barrel by a water-tight sack of India-rubber cloth, which prevents the escape of water between the bucket and the barrel. The valves are composed of a piece of leather or caoutchouc, which rests upon the upper surface of the bucket, on the top of which there is superimposed a plate of metal, to which a definite range of lift is given by a stop-pin, which it moves up and down.

A third improvement consists in the application of the sack packing described in reference to the pump, to the construction of a compressed-air buffer spring to prevent the escape of the compressed air between the cylinder and piston; and in the construction of a buffer spring formed by riveting two sets of springs upon the opposite sides of a plate inserted into the buffer case.

Claims.—1. The knuckle-joint connection for beam engines.

2. The arrangement described for the construction of pumps and buffer springs.

Alexander Wilkins, brewer, and William Stacy, engineer, both of Bradford, Wilts. *For a certain improvement or improvements applicable to heating and boiling of liquids of any kind or description.* Patent dated January 30, 1849.

A series of pipes or a coil of pipes is to surround the boiler to be heated, and to descend into the furnace flue. A set of conical projections are to be also formed on the boiler, and to dip into the flue. Any or all of these additions may be made to boiler or coppers, whether the same are heated directly by exposure to the fire surface, or placed in the flues of a fire which has been employed for another purpose.

Claims. — The above arrangements for heating fluids.

John Talbot Tyler, of the firm of Messrs. Ashmead and Tyler, of Mount-street, hatter. *For certain improvements in hats, caps, and hat-cases.* Patent dated January 25, 1849.

1. *Hats.*—Mr. Tyler makes the crown of his hats of a more curvilineal, and therefore more convenient and better-wearing shape than usual, and of such an articulate or jointed structure, both in the crown and brim, that they can be readily folded flat or re-expanded into their original shape, as required; but always in the same fixed lines only. The shape which he gives to the crown is that of a helmet, the obvious advantages of which are, that it is free in front and at back from the angular edges common to all cylindrical and conical hat-crowns with flat tops, and therefore less liable to injurious collisions and unequal wear. To construct the hat, so that it shall fold up in those lines only which are the most proper for the purpose, and always in the same fixed lines, he proceeds as follows (in technical language, this is called "forming the crose"):—If the fabric is felt or beaver, he either stops or leaves out the stiffening composition (usually a solution of

shell-lac) from the parts where the folds or "crosses" should be; or he afterwards discharges the stiffening composition from these parts; in both of which cases the unstiffened parts serve as so many joints or articulations. In the latter case, a hot solution of salts of tartar, borax, or some other chemical equivalent is applied to the joint parts, which discharges the shell-lac, and leaves these parts soft and yielding. The body is then ready to be roughed, that is, the napping put on, and then blocked in the form required, and afterwards dyed and finished. To form the joints or crosses in plated or silk hats, the patentee cuts the body quite through in the lines of the intended folds, and then connects the edges by laying over and cementing to them a thin strip of India-rubber, cotton, or other like suitable material, taking care to apply the strip so as to leave the edges a small distance apart, in order that they may not, on the folding of the hat, rub against or cut through the strip.

2. *Caps.*—The improvements specified, relate to felt caps only, and consist in forming them on the same block as the hats, and of one single piece, articulated or jointed so as to suit any desired form, and to fold up flat when required. The cap may be of the same helmet form as the hats, or of any other desired form. The articulating or jointing is effected by leaving out or discharging the stiffening composition from all those parts where the folds should be, in the same way as in the case of the hats.

3. *Hat Cases.*—The improvements in hat cases relate to travelling hat cases only of a square or oblong form, and consist in adapting them to a greater variety of uses than heretofore. As these hat cases are now commonly constructed, a place is provided for the hat only, and a considerable space between the crown of the hat and under the brim is left vacant. Now Mr. Tyler's improvements consist in turning the said vacant space to useful account, as a repository for articles required in travelling, and in forming also similar repositories in the sides, bottom, and top of the case, without materially increasing its general size.

Claims.—I declare that the improvements which I claim as constituting my said invention are as follows:

1. I claim the making of hats of the helmet form, whether folding or not.

2. I claim the making of every description of hats with folding joints or articulations, as before described.

3. I claim the making of caps in one piece, with joints or articulations similar to the hats, as before described.

And 4. I claim the hat case in the new arrangement and combination of parts of which the same consists, as before described.

William Henry Barlow, of Derby, C. E. *For improvements in the construction of permanent ways for railways.* Patent dated January 23, 1849.

The first of these improvements consists in making the rails with a base of such breadth that they shall require no other basement than the ballasting. The cross section of one of these rails is somewhat of the form of an obtuse triangle wanting the base; the broad apex in which it terminates at top forming the point of support to the wheels of the carriages.

A second improvement consists in adding a thin bar or plate of iron to the side of railway bars or rails, so that it may overlap the junctions of the rails, and be held in its place by the chairs. This arrangement is to make good the points of junction of the rails.

Henry B. Barlow, of Manchester, C.E. *For improvements in the manufacture of cut piled fabrics, and in machinery or apparatus applicable thereto.* (Being a communication.) January 29th, 1849.

The principal objects embraced by this patent are, the use of an additional warp and weft threads in weaving chenille, the pressing and cutting of the same, and the employment of wires in cut pile fabrics where the weft is cut. The details are illustrated by a great number of drawings, and could not be made intelligible without them.

Thomas Robinson, of Leeds, flax-dresser. *For improvements in machinery for breaking, scratching, cutting, hackling, dressing, combing, carding, drawing, roving, and spinning flax, hemp, tow, wool, silk, and other fibrous substances, and in uniting fibrous substances.* Patent dated January 23, 1849.

The patentee has disclaimed the words—"and in uniting fibrous substances." His claims in respect of the other matters included in his title, turn on the employment of aprons for feeding in the materials to the breaking rollers, instead of doing so by hand—of continuous sheets of hackles—and a combination of two continuous sheets of heckles, inclined in reverse directions.

Richard Johnson, of Blackburn, Lancashire, gentleman. *For certain improvements in the manufacture of malted grain, and in vinous fermentation; also improvements in brewing, and in the machinery or apparatus connected with the above or similar processes.* January 23, 1849.

Claims.—1. An improved description of machinery for preparing and drying malt.

2. Improved machinery for separating the seed and stalk of the hops from the leaves.

3. Improved machinery for mashing the

malt, so as to prevent its setting in the mash tun, and for tilting up the mash tun.

4. Cooling the wort by means of a confined current of air passing over the surface of the liquid.

5. Causing the yeast or other fermenting matter to be forced to the bottom of the wort to cause speedy fermentation.

CHARLES HENRY PARIS, of Paris, France. *For improvements in preventing the oxidation of iron.* (Being a communication.) January 23, 1849.

The articles to be protected are first cleaned by being dipped in dilute acid, then coated with gum, and dusted over with a powdered compound consisting of 120 parts glass, 20½ parts of carbonate of soda, 12 of boracic acid; next subjected to heat of 112° to dry the gum; and when dried introduced into a furnace, and brought to a heat sufficient to melt the glass upon their surface.

Claims.—1. The general arrangements described for coating articles of iron.

2. The application of carbonate of soda for that purpose.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
July 19	1967	Clayton, Shuttleworth, and Co.	Stamp End Works, Lincoln	Portable corn-mill.
,,	1968	William Handley	Chandos-street, Strand	Soil-pan valve.
20	1969	William Stedman Gillett	Woburn-place, Russell-square	Diaphragm to be used with a microscope.
23	1970	Auguste Motte	9, Southwark-square, Southwark	Portmanteau.
,,	1971	Richard Bell	Basing-lane	Fusee-cutting die.
25	1972	Mary Jane Rumney	Church-terrace, Walworth	Brooch protector and pin cap.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Alexander Ferrier Rose, of Greenvale-place, Glasgow, gentleman, for a certain improvement or certain improvements in the process or operation of printing, and in the machinery or apparatus employed therein. July 24; six months.

John Holt, of Todmorden, Lancaster, manager of the Waterside Works, for improvements in machinery or apparatus for preparing cotton and other fibrous substances, parts of which improvements are applicable to machinery used in weighing. July 24; six months.

Joseph Woods, of Barge-yard Chambers, Bucklersbury, for improvements in bleaching certain organic substances, and in the manufacture of certain products therefrom. (Being a communication.) July 24; six months.

LIST OF SCOTCH PATENTS FROM THE 22ND OF JUNE TO THE 22ND OF JULY, 1849.

Walter Neilson, of Hyde Park-street, Glasgow, North Britain, engineer, for an improvement or improvements in the application of steam for raising, lowering, moving, or transporting heavy bodies. Sealed June 25; six months.

David Smith, of New York in the United States of America, lead manufacturer, and a citizen of the said United States, for certain new and useful improvements in the means of manufacturing certain articles in lead. June 25; six months.

Edmund Grundy, of Bury, Lancaster, woollen manufacturer, and Jacob Farrow, of the same place, manager, for certain improvements in machinery or apparatus for preparing wool for spinning, and also improvements in machinery or apparatus for spinning wool and other fibrous substances. June 25; six months.

Robert William Laurie, of Carlton-place, Glasgow, North Britain, merchant, for improvements in means or apparatus to be employed for the preservation of life and property, such improvements, or part thereof, being applicable to various articles of furniture, dress, and travelling apparatus. June 25; six months.

Edward Hawkins Payne, of Great Queen-street, Middlesex, coach lace manufacturer, and Henry William Currie, engineer, for improvements in the manufacture of coach lace, and other similar looped or cut pile fabrics. July 9; six months.

Robert Urwin, of Ashford, Kent, engineer, for certain improvements in steam engines, which may in whole or in part be applicable to pumps, and other machines not worked by steam power. July 9; six months.

William Wilson, jun., residing at Campbellfield, Glasgow, Lanark, Scotland, for improvements in cutting plastic tubes or tiles. July 10; four months.

James Godfrey Wilson, of Millman-row, Chelsea, Middlesex, engineer, for certain improvements in obtaining perfect combustion, and in apparatus relating thereto, the same being applicable generally to furnaces and fire-places, as also to other purposes where inflammable matter or material is made use of. July 11; four months.

William Crofton Moat, of Upper Berkeley-street, Middlesex, surgeon, for improvements in engines to be worked by steam, air, or gas. July 16; six months.

William Kenworthy, of Blackburn, Lancaster, cotton spinner, for certain improvements in power looms. July 16; four months.

George Benjamin Thorneycroft, of Wolverhampton, Stafford, Ironmaster, for improvements in manufacturing railway tyres, axles, and other iron, where great strength and durability is required. July 16; six months.

Edward Ives Fuller, of Margaret-street, Cavendish-square, Middlesex, carriage builder, and George Tabernacle, of Mount-row, Westminster-road, Surrey coach ironfounder, for certain improvements in metallic springs for carriages. July 17; six months.

Peter Augustine Godefroy, of Wilson-street, Finsbury-square, chemical colour manufacturer, for certain improvements in dressing and finishing woven fabrics. July 18; four months.

John Grantham, of Liverpool, engineer, for improvements in sheathing ships and vessels. July 18; six months.

Joseph Eccles, of Moorgate Fold Mill, near Blackburn, Lancaster, cotton spinner and manufacturer, and James Bradshaw, and William Bradshaw, of Blackburn, in the same place, watch-makers, for certain improvements in, and applicable to looms for weaving various descriptions of plain and ornamental textile fabrics. July 19; four months.

Advertisements.

☞ *A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the substance of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d.*

Erratum.—Page 66, col. 1, line 9, from bottom, for "sulphur" read "saltpetre."

NOTICES TO CORRESPONDENTS.

LAW OF PATENTS.—THE REPORT OF THE ROYAL COMMISSION ON THE SIGNET AND PRIVY SEAL OFFICES, *has been published too late in the week to allow us to do more than print a portion of it in our present Number. In our next we shall give the remainder of it; and in succeeding Numbers, the principal portions of the evidence.*

Several communications of importance are unavoidably deferred.

The Supplement to our last Volume, containing Titles, Indexes, &c., will be published on the 1st of August.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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Edited by J. C. Robertson, 166, Fleet-street.

MR. BESSEMER'S FURTHER IMPROVEMENTS IN THE MANUFACTURE OF GLASS.

Fig. 6.

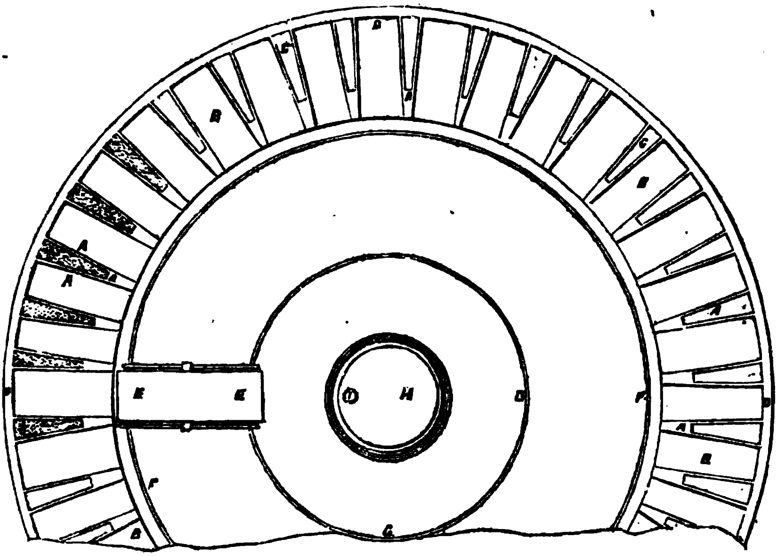


Fig. 4.

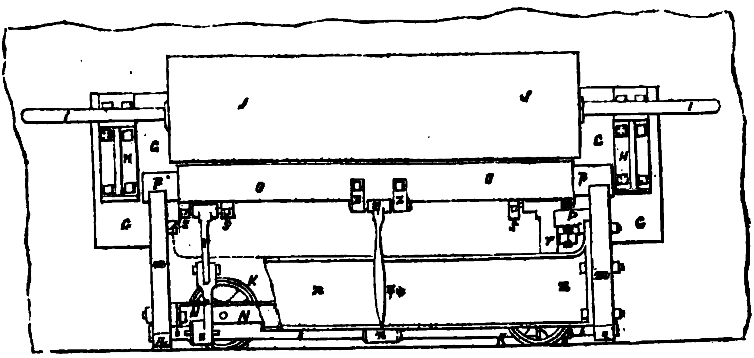
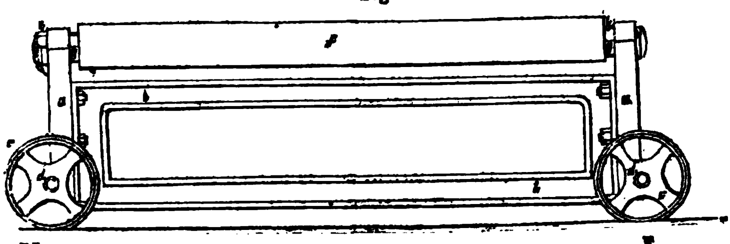


Fig. 2.



MR. BESSEMER'S FURTHER IMPROVEMENTS IN THE MANUFACTURE OF GLASS.

(Patent dated January 31, 1848. Specification enrolled July 31, 1848.)

The manufacture of glass makes slower progress in this country, than was anticipated from the repeal of the duties, by which it was so long fettered and obstructed. We ought to be able to make anything in glass which is made in metal; so strong, indeed, is this impression among the glass-makers themselves that they are in the habit of calling glass itself a *metal;* but we are still very far from having arrived at such a consummation. There are a great many articles still made in silver, brass, iron, &c., as well as other substances, for which glass would be much preferable. We might fill columns with instances of this, but we refrain from doing so, lest we should forestall the labours of any inventor whose ingenuity may be applying itself in this direction. Another circumstance worthy of note is, that such improvements as have been made since the repeal of the duties, have emanated chiefly from amateurs or persons not practically engaged in the manufacture of glass. The workers in glass themselves have done but little. Among these amateurs none has so distinguished himself as Mr. Bessemer, of whose previous successful labours in this department of art, the reader will find some account in our xxxvii. vol., p. 98. Mr. Bessemer's present patent has reference chiefly to plate glass, and is prefaced by an exposition of defects in the existing system of manufacture, which is quite startling for the amount of vulgar error and ignorant practice which it displays.

Whereas the ordinary casting table consists generally of a large plate of cast iron, from 12 to 15 feet in length, 5 to 7 feet in width, and from 4 to 6 inches in thickness, more or less, which is placed either on a bed of masonry or on a frame with wheels, and is planed to a true level on the upper or casting surface; and whereas, in order to cast plates of glass perfectly flat and of one uniform thickness, it is necessary that the table should maintain throughout the operation of successive castings, the same true plane as at first; but this is prevented by the unequal expansion of the iron; for as soon as the liquid glass is poured upon it, the upper surface of the thick table absorbs heat therefrom, and becomes expanded more than the under surface, producing thereby a slight curvature of the table, which curvature becomes greater and greater with the addition of each successive potful of glass. Again; the ordinary casting table is placed in a horizontal position, and the plate of cast or rolled glass has to be removed from it while in a soft state, and the force required to slide it off the table renders it necessary, that the end of the plate should be folded up, and a sort of peel or pusher placed within the folded portion, by which means the soft plate is made to move in the required direction, the folded portion going foremost. Although this causes a waste of the folded part, it is rendered necessary, by reason of the weight of the plate being too great to be pushed from behind edgewise on a horizontal plane, without putting it out of shape. Moreover, in the ordinary mode of casting on a table, the large roller which is passed over the glass to form it into a plate, is either allowed to fall down on a trestle when it arrives at the end of the table, or is removed on a frame with wheels; in either of which cases an interval is left between the end of the casting table and the mouth of the annealing kiln, equal to the diameter of the roller, which interval has to be filled up by a boarded or other surface, over which the soft glass is pushed into the oven; or the plate of glass is put upon a wooden truck, and wheeled by the workmen to the mouth of the annealing kiln.

And whereas also kilns have for a long time been in use for annealing plate or cast glass, having the bottom, or floor, formed with fire-tiles laid on sand, and it is frequently necessary to employ a workman to get into the kilns to re-adjust the tiles; nevertheless the general surface they present is neither flat nor uniform, and as the soft sheet of glass takes an impress of the irregular surface on which it is laid, it thereby requires much more grinding before it can be reduced to a true plane; besides which, it has to be made much thicker than is ultimately required, in order to compensate for the loss in grinding. Again; the arched roof or crown of such kilns is generally very thick, and covered over with sand or other bad conductor of heat: the consequence of which is that they cool very slowly, that several days are ordinarily occupied in the annealing process, and thus a great many more kilns are necessary than would be required if the kilns were cooled down more quickly. In the ordinary kilns, too, the heat is derived from one or more furnaces in immediate connection therewith,

and a flue, or flues, leading therefrom. By this mode of heating it is not possible to get an equal temperature at all parts of the kiln, since those parts nearest the furnaces will receive much more heat than the more distant ones; and when the kiln is closed currents of air are sure to traverse the kiln and flues, unless all the inlets and outlets are made absolutely air-tight, which currents must have the effect of causing an unequal cooling of the plates of glass within them. Farther, as the flame plays through the kiln, soot and dust, or fire-ashes, will accumulate therein, and add to the inequalities of the floor, arising from the other causes aforesaid.

Mr. Bessemer's improvements embrace remedies for the whole of the defects thus pointed out; and the nature of each will be gathered from the claims which we give in full at the end of this notice. We select for present illustration the first, second, and eighth heads, and shall in a future Number give the particulars of two or three of the others.

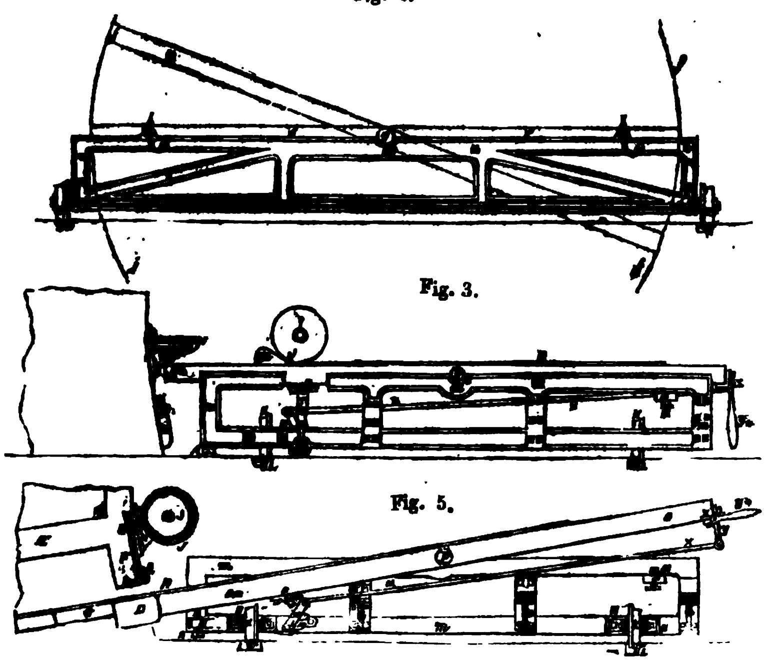
First Head.

The first head includes a new description of casting table, the peculiar features of which are, that it is planed true on both sides, and turns on trunnions,

Fig. 1.

Fig. 3.

Fig. 5.



"whereby the sides are used in alternate succession, the one after the other."

Firstly. I construct and use the casting table in the manner represented in figs. 1 and 2.

Fig. 1 is a side elevation, and fig. 2 an end elevation of the table. The frame consists of two side pieces, *a a*, connected together by two end pieces, *b*, and is mounted on wheels, *c c*, keyed on the axle, *d*, which work in bearings, *e e*, cast upon the frame. The wheels are for the purpose of allowing it to be easily removed from place to place when required. The table or surface, *ff*, on which the glass is cast or rolled, may be of the dimensions generally used: but instead of being fixed permanently in a horizontal position, it is supported on trunnion pins, *g g*, which rest in hollows formed at *a** in the side pieces; *i i*, are pins secured

to a chain, which pins pass through the side piece, *a*, and into holes made in the edge of the table to receive them.

Both surfaces of the table, *ff*, are to be planed true and level. The roller and guides, as well as the "tangs" or bars for determining the thickness of the plate, may be made and used in the ordinary way. When it is desired to cast or roll the contents of several pots of glass, the pins, *i i*, are inserted through the frame, in order to keep the table steady. The casting may then be proceeded with; and as soon as the plate of glass is removed from the top surface of the table, the pins, *i i*, are to be withdrawn, and the table moved upon its trunnions until the under surface becomes uppermost, when the pins, *i i*, are again to be inserted, and the casting of another plate of glass proceeded with. As soon as the second potful of melted glass is poured on to the table, the expansion of the surface in contact with the glass tends to neutralize the warping caused by the former operation, and by the amount of expansion being equalised on both sides, not only is the flatness of the table preserved, but its liability to crack is greatly diminished. In continuing the casting operation, the two sides of the table are to be used in regular succession. A hollow place must be made in the floor beneath the table, in order to allow it to turn round. The dotted lines, *j*, show the position which the table will assume at a particular part of a revolution on its trunnions.

Second Head.

Secondly. My invention consists in mounting such casting tables as are intended to be used on one side only, in such bearings and in such manner that the plates of glass may be moved from them at once into the kiln or oven without having to pass over any intermediate surface, and without requiring the end of the plate to be folded up as heretofore. Figure 3, is a side elevation of a table so constructed; fig. 4, an end elevation, with part of the framing, *n*, and some other pieces left out for the sake of showing the other parts more clearly; and fig. 5 is a longitudinal section taken through the centre of this apparatus. The framing of the table consists of two side pieces, *m m*, which are secured by cross pieces. The table, *o*, which is in this case formed of a large plate of iron, planed flat on its upper surface, is supported on trunnion pins, *p*, which project from each side of it, and rest in hollows, *m**, formed in the side pieces. On the under side of the table there are two levers, *r r*, which move in joint pieces, *s s*, which are secured by bolts to the table. On the lower edge of the side frames there are projections, *q*, into which the way-shaft, *t*, works at both ends. Levers, *u u*, are keyed at their lower ends on to the way-shaft, *t*, and the upper end, which is forked, is jointed to the levers, *r r*. When these levers, *r r*, and *u u*, are both in a vertical line, as represented in fig. 3, they form a support for the table. In order to change the horizontal position of the table, as shown in fig. 3, to the inclined position shown in fig. 5, it is necessary to cause the levers, *r* and *u*, to deviate from the vertical line, and for this purpose another lever, *w*, is keyed on the centre of the shaft, *t*, to which lever is attached by a joint the connecting-rod, *x*, the other end of which is jointed to the bent lever, *y*, which moves on a joint made in the angular piece of iron, *z*, which is bolted to the table.

To give the table the inclination shown in fig. 5, the handle, *y**, is to be pulled upwards, and its bent end acting on the rod, *x*, will cause the levers, *u u* and *w*, to move on their axes, *t*, carrying with them the lower ends of the levers, *r r*, and thereby causing the end of the table, *o**, to sink down until it rests on the ends of the adjusting screws, A A, one of which passes through projections, B, cast on both the side pieces, *m m*. C C represents a section of the portion of the floor of an annealing kiln, having a large block of stone or fire lump, D, partly projecting outwards from the mouth of the oven. E is the roof, and F the front wall, which is supported by a large plate or girder of iron, G, with a flange at G*, which extends entirely across the oven, and rests on the side walls. At the lower side of this girder, G, there is a narrow flap or door, Q, which extends across the oven, and closes the wide opening through which the plate of glass is pushed into the oven. The girder, G, has two iron brackets, H, securely bolted to it, and of such height above the table that the long projecting axis, I I, of the roller, J, may pass on to and rest upon these brackets. When the roller is moved to the end of the table, O*, the casting table is brought into its required place in front of the annealing oven by moving on flanged wheels, K*k*, which run on two lines of sunk rails, L L. These wheels are supported in iron frames, N N, which extend across the lower rail of the framing, and are bolted to the side pieces, *m*. When the operation of casting is to be performed, the table is wheeled to the front of the oven in which the plate is to be annealed; and the screws, M M, which pass through projections, P P, formed on the side frames, *m*, are turned so as to give a firm support to that end of the table. The roller used to form the plate of glass is then

put on the table, and made to rest on bars of iron at each side, by which the thickness of the plate of glass is to be regulated. The modes of preventing the spreading of the glass laterally, as also of pouring the glass and moving the roller over it, are similar to those in ordinary use in the casting of plate glass, and need not, therefore, be here described. In fig. 3 I have shown the roller advancing towards the annealing oven, leaving behind it a sheet of glass, R, and in front of it a portion of the soft mass, R*. By the further advance of the roller, the soft mass will be flattened out, and as soon as the roller has advanced so far that its axis passes on to the brackets, H H, the handle, y*, must be lifted, and the table thus made to assume the position shown in fig. 5, whereupon the roller, R, will be left upheld by its axis on the brackets, H H, as shown in fig. 5. The sheet of glass will then be pushed into the oven; the force required to do which will not injure the still soft plate, because the inclination of the table and oven is such that a very slight push from the end furthest from the oven will cause it to slide freely. As soon as the plate is within the oven, the flap, Q, must be shut down, and the table brought again into the horizontal position by the depression of the handle, y*. The table in rising will come in contact with the under side of the suspended roller and lift it off the brackets, H H. The roller may then be moved along the table to the opposite end, to be in readiness for a repetition of the casting process. The heating of the oven and the levelling of the bottom of it, may be effected in the manner at present practised, and all that is needful to adapt the oven to the improved process of casting, just described, is to make the floor of it incline to the same angle as the table.

Eighth Head.

The eighth of Mr. Bessemer's improvements consists of an improved arrangement or disposition of the kilns or ovens with reference to one another, and to the position of the melting furnace.

When plates or sheets of glass are made rapidly by any machinery, or when a large plate is divided into several smaller ones while hot, there is some difficulty in removing them sufficiently quick to the annealing kiln in which they are to be deposited, more particularly when such kilns are at a great distance. I therefore construct a kiln or oven within a suitable framing of iron, and by mounting the same on flanged wheels, it may be brought on rails to the spot where it may be required, the plates be deposited therein, and be again moved to some distant part where it will be out of the way during the cooling down of the plates or sheets of glass. Fig. 5 is a vertical section of this apparatus, and fig. 6 a front elevation of it. A is an angle iron frame, which incloses the kiln on all sides, and has folding doors, B, in front of it. The whole of the exterior framing, including the doors, is filled with brickwork, C, in order the better to retain the heat. In the lower part there are four small fire-places or furnaces, D, two of the doors of which are seen at E in fig. 6 (the other two, which are not seen, are at the back.) F is a hollow space between the furnaces, the top of which is covered by a thick fire-lump, G. The fire chambers are also covered by a similar fire-lump, having two or three rows of holes, H, in them, for the purpose of allowing the heat to ascend into the body of the kiln, J. I, is an arched roof, which is also provided with holes, K, for the products of combustion to ascend through. The doors, B, have knobs, L, by which they may be opened, and a handle and catch, M, to keep them shut. When this kiln is required for use, a small fire is to be lighted in each of its furnaces. The heat must be augmented gradually, and when the whole of the interior presents a dull-red appearance, the sliding dampers, N N, are to be pulled beneath the fire-grate to prevent all further access of air, and the holes, K, in the crown, are also to be stopped with a plug of burnt clay, and the joint further secured by a little wet clay. The kiln may then be moved upon its wheels until it arrives at a convenient place to receive the glass. The doors, B, are then to be opened, and the plates quickly set up on edge, leaning against the back of the kiln. This mode of setting up the plates on edge is called piling, and is so well understood as to require no further explanation here. The doors are to be closed as quickly as possible, and the joints made tight with clay, when the whole may be removed in order to make room for a similar operation with another lime kiln.

In works already constructed for the casting of plate glass, the kilns for annealing it are placed at different distances from the furnace in which the glass is rendered fit for casting. The more distant are from 150 to 250 feet off, rendering it necessary either to transport the pot of fluid glass a considerable distance from the furnace to the casting table; or if the casting table be near the furnace, then the soft sheet of glass has to be removed to the annealing kiln, after casting, on a wooden truck. Both these modes add much to the labour of casting, and where the pot has to be carried a considerable distance, the time occupied in removing it greatly adds to its liability to crack from change of temperature. To avoid the many

disadvantages attending the great and irregular distance of the annealing kilns from the furnace, and to render access to all equally easy, I construct the annealing kilns in a circle, with the glass furnace occupying the centre. The casting table or other apparatus to be used in casting or forming sheets of glass is to be mounted on wheels, so that it may move on rails in a circular direction around the furnace. This arrangement will be clearly understood by reference to fig. 6, which represents a ground plan of a circular building, around the outside of which the kilns are formed. A A, are the walls which divide the kilns from each other; B B, the kilns; C C, the spaces left between them, which are filled with concrete; D, the outer wall, which serves also for the end wall of the kiln; E, the casting table, supported on flanged wheels, which run on two concentric rails, F and G. The furnace, H, in the centre, I prefer to be constructed on the plan for which I obtained letters patent, dated the 22nd of March, 1848. I, is the opening through which the pots are removed. It will be observed, that whenever the crown of the furnace is moved round so as to get at the pot, the casting apparatus may also be moved upon the rails, and thus, during the casting of any number of pots of glass, the casting apparatus will present that end to the furnace on which the fluid glass is to be poured, and at the same time it will present the opposite end close to the mouth of the kiln, thus affording the greatest facility for its quick removal In order to carry out this system completely, the kilns should occupy the entire outer circle, as here represented; in which case access to the circular casting hall can be most conveniently had by steps from the "cave" below. Entering the hall between the rails, access to the "cave," or lower room, will be as usual, viz., by a simple inclined path or roadway, leading from without the building to the lower or underground passages or caves. It will, of course, be necessary to place the axles of the wheels which support the casting table in a position diverging from the centre of the rails; and if the wheels are keyed on to their respective axles, those running on the rail, F, should be larger in diameter than those running on the rail, G. The proportion which the said wheels bear to each other should be in the same ratio as the diameter of the two rails.

Claims.

Having now described the nature of my invention, and in what manner the same is to be performed, I declare, that although I have herein described several processes, apparatuses, and pieces of machinery, which are already to some extent more or less known and in use, I claim the same only in so far as regards my improvements therein, which are as follows:—

First. I claim the employment in the manufacture of glass of casting tables, planed true on both sides, and turning on trunnions, whereby the two sides may be used in alternate succession, the one after the other, to cast the plates of glass upon, as before described.

Second. I claim the mounting of casting tables intended to be used on one side only, on such bearings, and in such manner, that they may be raised from a horizontal position to any angle of inclination that will most facilitate the removal from them of the plate of glass when cast, as before described. I claim also the mounting of the rollers used in connection with such casting tables, in such manner that when the plate of glass is about to be removed form the casting table into the annealing oven, the roller passes from off the glass on to supporting brackets fixed in front of the annealing oven, or at the sides of the latter, and is there supported till its services are again required, as before described.

Third. I claim the constructing of tables for casting glass of a number of separate detached pieces, made fast to one bed plate; as before exemplified and described.

Fourth. I claim the constructing of tables for casting glass of a number of separate and detached pieces, connected and arranged in the manner of an endless chain, and the machinery for working the same—both as before described; but the latter only in the general combination of parts of which it consists, and their adaptation to the moving of tables for casting glass.

Fifth. I claim the employment in annealing glass, of beds composed of solid detached blocks, of greater depth or length than width, and adjusted to an exact level on their upper surfaces, by means of screws, one to each block, operated upon from beneath, and the whole laid in a box or framework mounted on wheels, so that they may be withdrawn at pleasure from the oven; as before described.

Sixth. I claim the constructing of annealing ovens with a double crown and sides; as before described.

Seventh. I claim the heating of annealing ovens or kilns by the circulation through them of heated metal in pipes or chambers, and the apparatus before described for heating the said fluid metal, and supplying or drawing off the same, to or from, the pipes within the kiln. I claim also the application of the said method of heating by means of fluid metal to the annealing of glass tubes; as before described.

Eighth. I claim the arrangement of annealing ovens in a circle round a central furnace, having concentric rails, as before described. And I claim also the construction of kilns mounted on wheels, and containing heating furnaces, as before described.

Ninth. I claim the improvements in spreading or flattening kilns, before described; that is to say in so far as regards the employment of retorts of fire-clay and iron, the method of tilting the flattening stone, and the method of setting up the sheets of glass.

Tenth. I claim the forming of glass pots with hollow bottoms, and with shoulders or arched openings beneath, as before described.

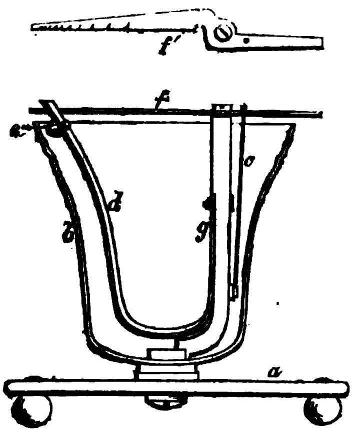
Eleventh. I claim the fastening of sheets of glass to the grinding frames, with gutta percha or compounds thereof, in the manner before described.

THE SONOMETER.

The *Lancet* of last Saturday (July 28) contains a most interesting account of an instrument which has been invented by Mr. Thomas Wakley, the surgeon of the Royal Free Hospital, to be used during the treatment of deafness in all its varieties. The sonometer tests with the greatest accuracy the amount of hearing a person actually possesses in every stage of the affliction; the advantage of this must be evident. When we consider the number of persons professing aural surgery — the majority having no *locus standi* — not being members of any medical or surgical college, and having no other claim upon society than their advertising notoriety, we must hail with great satisfaction the introduction of an instrument which must inevitably prove a death-blow to these speculators upon the credulity of the public, relying as it does but too often upon the specious advertisements set forth in the columns of the daily and weekly journals. With the aid of the sonometer, no doubt can exist either in the mind of the patient or surgeon regarding the progress of the case under treatment. The capacity of each ear is precisely and accurately measured as regards its exact appreciation of sound, and even the most simple or uninitiated, can by this instrument decide what progress has been made towards a cure.

We understand that Mr. Wakley has introduced this instrument as an ally to the treatment of diseases of the ear, with *Glycerine*, which appears to have been highly successful in its results from possessing the peculiar property of attracting from the atmospheric air moisture, and consequently never drying or hardening.

The accompanying wood-cut and description will introduce to our readers an adequate idea of this highly useful and ingenious instrument.



The sonometer is a simple and easily managed instrument, and consists of a small bell, *b*, fixed on a table, *a*; the pillar, *g*, which supports a serrated bar, *f*, is kept in its place by a delicate spring, *c*; the spring, *d*, has attached to it a small hammer, *e*; this spring being placed in the teeth of the serrated bar, *f*, is relieved by the handle, being touched by the finger, which regulates the extent of sound, from the ticking of a watch to the sharp, loud tone of a bell.

URWIN'S PATENT FLUSHING PUMPS.

We now proceed to describe the application of Mr. Urwin's original excellent system of clearance or exhaustion (see *ante* p. 50,) to pumps.

Fig. 14 is a longitudinal section of a single acting force-pump, on this plan of construction; and fig. 15, a plan on the line *m*, *n*. A is the pump-barrel, and B the ram. C is a bush, which is fitted into a place made for it in the body of the barrel, at about the middle of its length, (forming, in effect, a middle piece to the barrel,) and

has four openings through it, F F F F. An external elevation of this bush, detached from the rest of the pump, is given in fig. 16. D is a jacket, or casing, which surrounds the bush C with its four openings, F F F F, and communicates at one side with the water supply-pipe E. G is the outlet discharge-pipe, and H a ball clack valve, attached to it, which acts as a stop-clack. The mode of operation will be obvious. On drawing up the ram B, the space between the bottom of it and the ball-clack valve H is more or less exhausted of air; but as soon as the ram begins to pass clear of the openings F F F F in the bush C, the water rushes in from all sides into the exhausted space beneath it, and is by the return of the ram forced through the ball-clack valve H, to a height proportionate to the force employed.

Fig. 15.

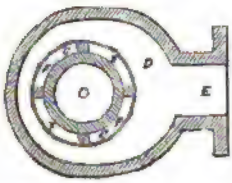


Fig. 17.

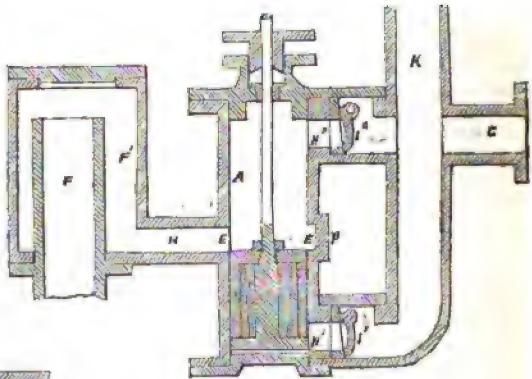


Fig. 14.

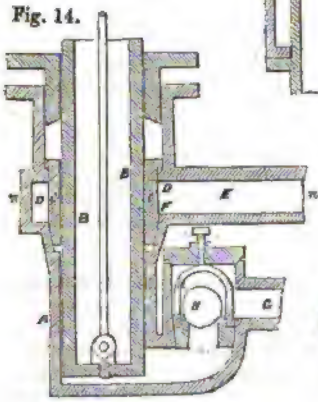


Fig. 18.

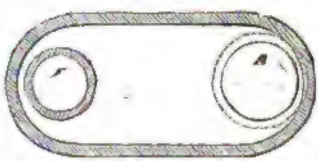


Fig. 16.

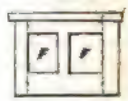


Fig. 17 is a longitudinal section of a double-acting lift and force-pump, on the same plan as the preceding, but with the jacket or casing in the centre; as in the case of the steam engine first before described. Fig. 18 is a cross section on the line o, p of fig. 17. A, is the barrel; B the piston, which is packed in the manner shown in fig. 17, and made of such depth in proportion to the length of the barrel, that at the termination of the stroke either way, the piston shall pass clear of the opening H. E E, a jacket or casing which surrounds the opening, H, in the barrel. F is the water supply-pipe, which terminates in a cistern or chamber F, which communicates with the jacket or casing E. G, is the delivery-pipe; H^1 and H^2, the lower and upper ports of the barrel which lead to the delivery-pipe G; and I^1 and I^2, the clacks which command these ports. As the pump is represented in the drawing, the piston is at the termination of its down stroke, and the upper part of the barrel filled with water, ready to be ejected through the upper port H^2 and clack-valve I^2. Supposing, therefore, the piston to be now drawn up, it will first close the middle opening H, and the space between the bottom of the piston and the clack-valve, I^1 will be more or less exhausted; but as soon as the bottom of the piston begins to pass clear of the opening H, the water will rush in from all sides beneath the piston, while the piston, by its continued ascent, will expel the water in the upper part of the barrel through the port H^2 and clack-valve I^2. On again depressing the piston, the reverse action will take place; that is to say, the upper part of the barrel will be exhausted; and when the top

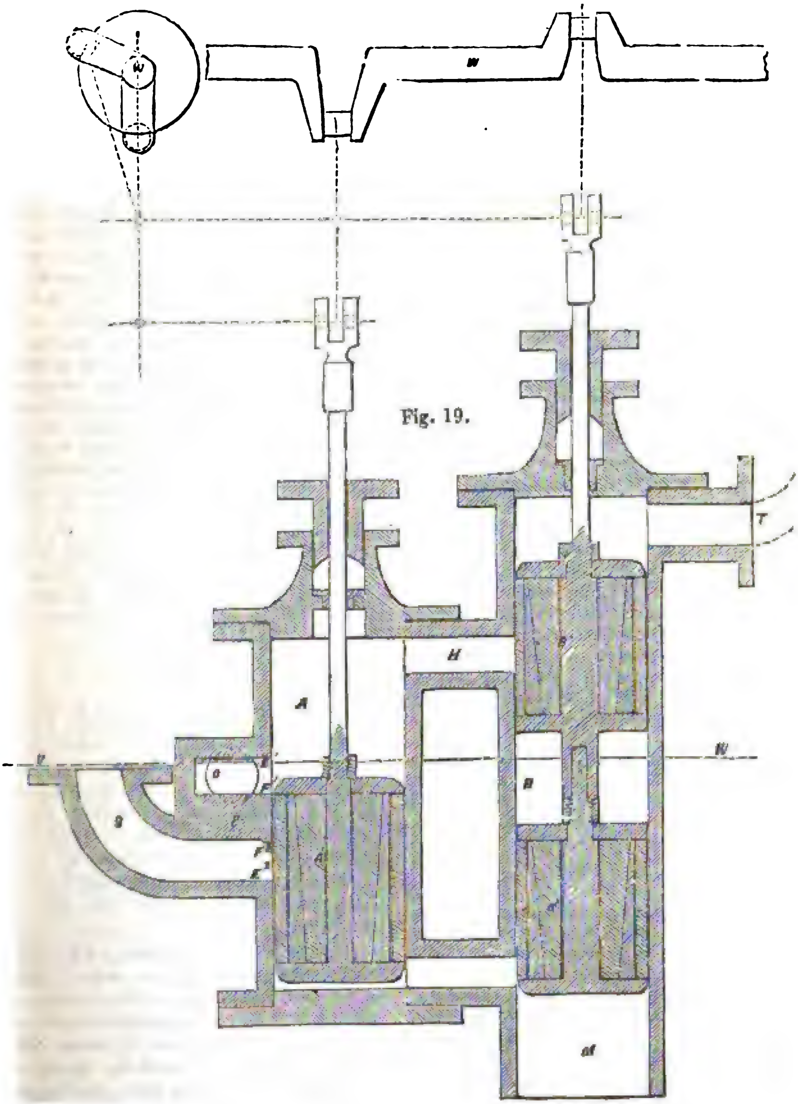
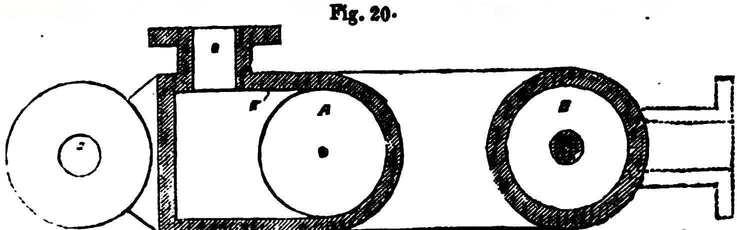


Fig. 20.



of the piston passes clear of the opening H, water will rush in through that opening into the exhausted space, while the piston, on completing its descent, will expel the water in the under port of the barrel through the port H^1 and clack-valve I^1. And so the pump will go on working continuously, ejecting a body of water at every stroke, either from the upper or lower port of the barrel.

Should it be desired to obtain a continuous stream of water from a double-acting pump, such as that just described, all that would be necessary would be to attach a short branch pipe to the delivery-pipe at K, and to mount an air-vessel thereon, in the same way as is done in the case of fire-engines.

In both of the pumps which have been described, only stop-clack valves are used; but in figs. 19 and 20 a modification is represented, in which clacks are wholly dispensed with, and the inconveniences attending the use of such contrivances completely avoided. The pump here shown is supposed to be applied to a water-closet on board ship, in order to lift the water required and force away the soil, for which purpose it appears to be particularly suitable. Fig. 19 is a sectional elevation of the pump, and fig. 20 a cross section on the line, *v w*. A and B are two barrels; the barrel, A, has two openings, F^1 F^2, on one side, at about the middle of its length, which are separated from each other by a partition, *p*. The opening, F^1, is surrounded by a jacket or casing, E^1, into which water is admitted by a pipe, O, from the outside of the vessel, whence it is forced into the basin, as afterwards explained. The opening, F^2, is also surrounded with a jacket or casing, E^2, which receives the soil, and from which it is afterwards ejected by the operation of the pump. A^1 is the piston of the barrel, A, which is made in proportion to the length of the barrel, of such depth, that whether it is at the bottom or at the top of the barrel, it shall cover only one of the two apertures, F^1 F^2. The barrel, B, is longer than the other, and fitted with two pistons, B^1 B^2, attached to one rod, and intermediately connected together in the manner shown. These pistons perform the office of two clack-valves, the upper one alternately opening and closing the top passage, H, between the barrels, A and B, through which passage water is forced from the barrel, A (through the barrel, B, and a recurved pipe, T, indicated in the figure by dotted lines), over into the soil-pan which is fitted upon the pipe, S; and the other one alternately opening and closing the passage, L, by which the soil which has been admitted into the bottom of the barrel, A (through the opening, F^2), is discharged into the river or sea. The piston-rods of both barrels are connected to one crank-shaft, W, and so adjusted in respect to one another that as often as by the throw of the crank the piston, A^1, is raised to the top of the barrel, A, it shall simultaneously open the passage from the soil-pipe, S, into the barrel, A, and force up a supply of water into the basin fitted on the pipe S; and as often as it is depressed (the piston of the barrel, B, being proportionately raised) shall close the passage, H, and open the passage, L, the soil being discharged at that instant through the pipe, M, into the sea. The pistons, B^1 and B^2, in order to answer the preceding conditions, must have a lap on each side equal to the depth of the ports or passage ways; and the proper depth to be given to these ports or passage-ways may be found by letting fall a perpendicular from the chord of 120° of a circle, whose diameter is equal to the stroke of the pump, which perpendicular (the sine of the chord) will be the depth required. The pistons also must be connected to the crank-shaft at an angle of 60°, and the connecting-rods, as also the throw of the cranks, must be of equal lengths.

ON THE FLAMBING OF SHIPS' BOWS.

Sir,—The admission contained in the first paragraph of "B. I.'s" reply, is only what I expected from his candour, and he will permit me to trespass further upon it by asking him to read again *attentively* and *dispassionately* what I have previously written, together with this, as I am sure it will end our controversy.

In his second paragraph, alluding to my having said that the want of buoyancy was compensated for by the less weight and larger displacement of other of the foremost sections, he says, "*this, I must confess, is contrary to my conceptions.*" Why, the very conditions of the question require that it should be as I state—that is, a certain waterline in each vessel is supposed, and does obtain, as the result of an equilibrium between the moments of the weights and the moments of buoyancy; the waterline being a condition, the weights can only be removed correspondingly forward and aft, and doing so, does not interfere with my position. True, if equal weights be moved equal distances in each vessel towards

their extremities then the total moments of inertia of their extremities will be increased equally; but the original difference in the amount of these moments will remain; that is, they will be greater in A, because of the greater displacement of the section for that from the centre of oscillation, and also the moments of inertia of the weight of hull will be greater in A, because *of her wider decks, longer bow timbers, greater scantling of beams for equal strength with* B, *and greater area of planking*. "B. I." says, "that B has the centre of gravity of displacement of the fore-body *nearer* to the centre of gravity of the whole displacement, and that a greater force is necessary in order to lift or support *the deficient* section forward." Now, here it is, that "B. I." loses himself with respect to weight—there is no deficiency; were there so, there would not be an equilibrium—there would not be the given waterline, it would change; but a deficiency or excess arises the movement that equilibrium is destroyed by the water or by its absence, not by greater or less weight, but by greater or less buoyancy. The dimensions of the bow, A, above water, being greater, a greater buoyancy will be added by the wave, and because its dimensions are greater below the water-line, she will lose more buoyancy than B when this portion of their bows respectively, is in the hollow of an equal wave.

"B. I." says further, "*When the crest of the wave arrives a little abaft the common centre of gravity, the falling moments, which are as the square of the distance from the centre of oscillation, will be much larger in the bow* B." This is in direct contradiction of his statement just above, that "B *had the centre of displacement of her fore-body nearer to the common centre of gravity*." Now the moments of the weights must follow the moments of the water, or else we shall have a new water-line, and the moments of buoyancy of A being greater than the moments of her weights, must do so also; and therefore the moments of inertia, that is, supposing them equally well stowed, the form of B offers no difficulty to this, and, therefore, it is but rational to suppose an adherence to principles were possible; indeed, it is only the incorrect form that obliges a departure.

The following occurs in the fourth paragraph, "*The more sudden plungings, and very often entire burial of the sharp, yet heavy, bow in the waves*." This is sheer prejudice; Sir William Symonds's latter brigs have had longer bows, and they have sailed better against a head sea. The *Flying-fish*, as compared with the *Columbine* or *Pantaloon*, further proves that which he states cannot be the case; with which, if he be not satisfied, I must recommend him a trip down the Channel in the *Raleigh* or *Acteon*, with a foul wind, a head sea, and a man of some nerve to put sail on the ship; if he be not bumped into a conviction, I would recommend the same trip, under similar circumstances, but in the *Eurydice* or *Penelope*—even the *Constance*.

Then "*sharp yet heavy;*" this is a contradiction—sharp, is of little displacement, therefore of little weight, and therefore *not* heavy.

"B. I." says, "'F.' supposes the two vessels under similar circumstances;" he should have added except form, and *that* difference involves a different position of the moveable weights; for where the greater displacement is, there must be also a greater amount of the disposable weights. I have already shown that the weight of the guns in a man-of-war is but a small item in the whole weight of a ship and lading, and yet it is only a very small portion of their weight that can be thought even to enter into this question.

"B. I." says, "the increased weight of hull being only as the increased breadth of decks;" this I have shown to be wrong—the overlooking the weight of hull, consequent upon change, of form has cost the country many failures. He makes a further statement, which is clearly an oversight, viz., "That the increase of displacement is as the cube of the breadth."

Again; "*A sharper fore-body is believed to carry the centre of effort of the sails more forward*." This has nothing to do with the question; for if the foremast be carried further forward, an equal weight must be carried correspondingly aft to preserve the water line. I deny, however, his position; the Navy affords as many proofs against as for the truth of his statement.

I may take up this question as an im-

portant one, of which little or nothing is known in the Navy: our ships are masted, that is, the positions of the masts are chosen, by the Rule of Thumb—certainly nothing more intelligible.

"B. I." will allow me to thank him for his full admission that "the flambing form of bow is contrary to true principles;" but I cannot answer his question, "Are we not forced always to violate true principles in naval science, where so many opposite qualities are necessary?" in the affirmative; that which involves the necessity for a violation of principle does not deserve the name of science. I deny the position altogether, assured that if principles be violated, defects or failure will necessarily ensue.

I am, Sir, yours, &c.,

F——.

LAW OF PATENTS.—REPORT OF THE COMMITTEE ON THE SIGNET AND PRIVY SEAL OFFICES.—(CONCLUDED FROM P. 91.)

It is impossible to ascertain with certainty when grants of letters patent for the sole use of inventions were first made in this country, but there is reason to believe that this prerogative of the Crown is very ancient.

The Crown derives this prerogative from the common law, and not from any statute. It is vested in the Crown as the depository of the supreme executive power of the State, to be exercised on the behalf and for the benefit of the public.

No statute is to be found relating to grants for the sole use of inventions prior to the statute of 21 Jas. I., c. 3, called the Statute of Monopolies.

That statute was passed for the purpose of restraining the Crown from making extravagant and illegal grants of monopolies. It declared all monopolies whatsoever to be contrary to law and void, excepting "letters patent and grants of privilege of the sole working or making of any new manufacture to the first inventor thereof."

The only other public acts relating generally to patents are the 5 and 6 Will. IV., c. 83; 2 and 3 Vic., c. 67; and 7 and 8 Vic., c. 69, which provide remedies for deficiencies in the old law.

The grants of the Crown must be made by charters or letters patent under the great seal, and the command given to the Lord Chancellor to make a patent for an invention is always by means of a writ, or bill, sealed with the privy seal, because the Queen cannot herself make her letters patent except by means of her ministers, who act according to her legal commands; and therefore when the patent is written, the words "By Writ of Privy Seal" are inscribed, to show by what authority the Lord Chancellor seals the grant.

The present practice in regard to the granting of patents for inventions is, that, in the first instance, a petition to the Queen is left at the office of the Secretary of State for the Home Department. The Secretary of State refers that petition to the Attorney or Solicitor-General to consider and report thereon, in order that the Crown may be advised respecting the legality of the grant sought for, and the expediency of granting it. Upon the petition being left at the chambers of the Attorney or Solicitor-General, the title of the invention inserted in the petition is compared with the descriptions which are contained in all the existing caveats in the office. If the invention be not affected by any of those caveats, the patent is allowed to proceed; but if the title appears to relate to an invention which comes within the general description contained in any of the caveats, notice of the petition is sent to each party who has entered such a caveat.

A caveat against a patent is, in substance, a request in writing that a patent for a specified purpose be not granted without notice to the party who enters the caveat. Caveats may be entered at the chambers of the Attorney or Solicitor-General, at the Patent Bill Office, at the Signet Office, at the Privy Seal Office, and at the Patent Office of the Great Seal.

The following are the proceedings on a caveat before the Attorney or Solicitor-General at the report, or first stage:—

The parties to whom notice has been sent are allowed seven days, within which they must enter their opposition, if they intend to oppose the patent. If no opposition take place within that time, the patent proceeds, as of course. If the patent be duly opposed, the proceedings are arrested, and the applicant for the patent must obtain an appointment for a hearing before the Attorney or Solicitor-General, and a summons is served upon the opposing party.

After hearing the parties separately, if the Attorney or Solicitor-General be of opinion that the Queen ought to be advised to grant the prayer of the petition, he reports in favour of the petitioner, and the report is left at the Home Office in order to obtain the Queen's warrant. If the opposition be successful, no report is made, and the application drops.

The Queen's warrant contains Her Majesty's authority to the Attorney or Solici-

tor-General to prepare a Bill for the intended patent. When completed, it is taken to the Patent Bill Office, which is an office of the Attorney and Solicitor-General, where all Bills for Patents to pass the Great Seal are prepared.

Upon the receipt of a warrant for a Bill, the engrossing clerk will prepare the Bill as a matter of course, according to the established form, if no caveat have been entered against it in that office.

Any person may oppose a patent at this stage, whether he have opposed at the previous stage or not; but as a necessary preliminary, he is required to deposit the sum of 30*l*. as a security for the costs, which his neglect to oppose earlier causes the applicant for a patent to incur.

The hearing at this stage is conducted in precisely the same manner as at the report.

If the opposition be successful, all further proceedings are stayed; if not, the Bill is passed and submitted to the Queen for signature.

The Bill, thus completed, is the Queen's Bill, and is passed to the Signet Office, where it is filed, as the warrant to the Clerk of the Signet fot preparing and issuing the Signet Bill to the Lord Privy Seal.

The Signet Bill is in like manner filed at the Privy Seal Office, as the Lord Privy Seal's warrant for his proceedings.

Though caveats may be entered both at the Signet and Privy Seal Offices, opposition is now never made at either of these stages of a patent.

Friday is the only public sealing day at the Privy Seal Office; but a Bill may be sealed, at a private seal, on any other day on payment of an additional fee of 2*l*.

After the delivery of the Privy Seal Bill, the proceedings for obtaining a patent take place on the common law side of the Court of Chancery, where there are several officers whose duty it is to prepare, seal, and enrol Letters Patent.

The grant of a patent may be again opposed before the Lord Chancellor. In that case the applicant for the patent must prepare a petition stating all the facts and proceedings, and praying that Letters Patent may be made and sealed in pursuance of the writ of Privy Seal. The material allegations of this petition must be supported by affidavit, to be sworn before a Master in Chancery, and the petitioner's opponent must be served with a copy of the petition and of the Lord Chancellor's answer to it.

Upon application for that purpose, a day is fixed for a hearing before the Lord Chancellor, who generally refers the matters of the petition and opposition to the Attorney or Solicitor-General for a special report.

The parties are then again heard by the Attorney or Solicitor-General upon this reference, and if they are satisfied with his report, the Lord Chancellor makes an order in accordance therewith. But if either party be dissatisfied with the report, he must prepare a petition to the Lord Chancellor stating his exceptions to the report, and the Lord Chancellor will then, after again hearing the parties, dispose of the petitions as he may think just.

If a patent be not opposed at the Patent Office of the Great Seal, it is sealed in pursuance of the writ of Privy Seal. If the patent be opposed, and the Lord Chancellor decides on granting it, it will be sealed as soon as his Lordship's order for the purpose has been drawn up.

A recipe is first written in the margin of the Privy Seal Bill, stating the day when the Lord Chancellor received the Bill.

The Clerk of the Patents then engrosses the patent, copying it verbatim from the Privy Seal Bill.

He also prepares a docket for the Lord Chancellor's signature, containing the name of the party to whom the patent is granted, the title of the invention, the extent and duration of the grant, the time allowed for specification, and the date of the grant.

The recipe and docket are signed by the Lord Chancellor; the latter instrument being the warrant to the sigillator or sealer, who affixes the Great Seal to the patent after satisfying himself that it corresponds with the docket.

The patent having been sealed, all the documents are taken back to the Patent Office, where the patent is put into a box and delivered to the patentee.

Every patent for a new invention contains a proviso that the patentee shall describe his invention by an instrument in writing, under his hand and seal, termed a specification, and this specification must be enrolled in Chancery within a given time after the date of the patent. In default of which the patent becomes void.

Up to the 1st of January last there were three offices in which specifications might be enrolled, viz.:—

The Enrolment Office,
The Petty Bag Office, and
The Rolls Chapel Office.

The patents themselves, together with the Privy Seal Bills and dockets, are enrolled at the Enrolment Office, where the rolls are kept for two years, and then sent to the Petty Bag Office, whence, after the lapse of a certain number of years, the Patent Rolls and Privy Seal Bills are finally sent to the Rolls Chapel.

By an Act passed in the last Session of

Parliament, 11 and 12 Vic., c. 94, it is enacted, That from and after the 1st of January, 1849, all specifications shall be enrolled in the Enrolment Office. Since that period, therefore, the necessity for enrolling specifications in the other two offices no longer exists.

After considering the evidence, we have come to the conclusion that the number of successive stages through which (as will be seen from the foregoing detail), a patent for a new invention must pass before its final completion, is productive of great trouble, delay, and expense to the party seeking the grant, without any corresponding benefit to the public.

The fullest opportunity should, no doubt, be afforded to all persons whose interests may be affected by the grant of an exclusive privilege to manufacture some particular article, to show that good grounds exist why the privilege should not be granted to the party applying for a patent.

The object of granting a patent for an invention is, not merely to secure to an inventor the fair reward of his labour and ingenuity, but also to benefit the public by encouraging such inventions, and it is essential that the Crown should have some tribunal to refer to, for advice before making such grants.

With these objects in view, it has not appeared to us that any better course can be devised than a reference to the Attorney or Solicitor-General, to inquire into the merits of the circumstances set forth in the petition, and report thereon to the Crown.

The inquiry would appear, for the most part, to involve considerations rather of a legal than of a scientific nature. But should questions arise, on an opposed petition, where a more than ordinary familiarity with scientific subjects might seem requisite for the due comprehension of the matter under investigation, the Attorney or Solicitor-General would always have the power, which they now possess and exercise, of calling in some man of practical science, unconnected with the parties before him, and unprejudiced in the matter in dispute, to aid him in coming to a just decision.

We think, however, that ample opportunity having been given for making opposition at this stage of the proceedings, no adequate advantage is derived from a second opposition at the Patent Bill Office. It seems, moreover, that oppositions at that stage are of unfrequent occurrence.

If this opinion should be adopted, and the proceedings at the Patent Bill Office be dispensed with, we would then recommend that some public notice, by advertisement in the *Gazette* or otherwise, should be given, that a patent for a particular object has been applied for, not naming the applicant, or giving more than a very general description of the object of the invention; and that a sufficient number of days should be allowed from the date of the advertisement before proceeding with the petition, in order that a fair opportunity for opposition may be afforded to parties desirous of opposing the grant sought for.

We would also recommend that an outline description, such as is now required to be deposited with the Attorney or Solicitor-General, in cases of opposed patents, should be required to be lodged, under seal, with every petition on its first presentation at the Home Office. It is not proposed that this outline description or specification should supersede the specification now required to be enrolled in Chancery, nor that it should be required to enter into the details of the invention; but that it should be considered binding as to the principles of it.

With these provisos we are of opinion that a patent when granted might take its date from the day on which the petition is presented, instead of, as at present, from the day on which the patent is sealed.

We would further suggest for consideration, whether, after the report of the Attorney or Solicitor-General recommending the grant of the patent, a Queen's Bill, carrying the recommendation into effect, might not be prepared at the Home Office, and submitted by the Secretary of State for Her Majesty's signature. We see no reason why it should be engrossed on parchment; we think, on the contrary, it would be far more convenient, if it were prepared after the manner of an ordinary Sign-Manual Warrant.

We are of opinion that the Queen's Bill, when duly signed, should be passed at once to the Lord Privy Seal, without the intervention of the Signet Office; that the Privy Seal should be affixed to that instrument upon the authority of an instruction to that effect from the Secretary of State; and that the two transcripts prepared in the Patent Bill Office, which now form the Signet and Privy Seal Bills, should be dispensed with.

We, at the same time, recommend that the public seal days in the Privy Seal Office should be extended to two days in the week.

If the proceedings in the Patent Bill Office and in the Signet Office be entirely dispensed with, the fees now payable at those offices must of course cease to be levied. It becomes, therefore, necessary to revise the charges to which letters patent are liable in passing through their several stages previously to their arrival at the Great Seal.

In the case of patents for inventions, the confining the opposition before the Attorney and Solicitor-General to one stage only, will probably render necessary a more rigid investigation at that stage than is required under the present system, and will throw increased responsibility upon the reports of those officers. We consider that, under these circumstances, the Attorney and Solicitor-General would have a fair claim to a higher fee for the single hearing and report than is allowed to them at present. We recommend, therefore, that one fee of 10 guineas should be allowed to the Attorney or Solicitor-General for the hearing and report together (including the fees to their clerks), instead of the separate fees they now receive, amounting to 3*l*. 5*s*. for the hearing, and 4*l*. 4*s*. for the report.

We further recommend that, in lieu of requiring successive payments of fees and stamp duties at the several public offices, a stamp should be affixed to the Queen's Bill in the department in which it is prepared.

In the case of patents of appointment to office, the amount of this stamp might be a small per centage on the salary of the office.

In the case of patents for inventions, we would recommend a stamp of uniform value, without reference to the number of names included in the grant. Should it be determined to extend the power of granting patents under the Great Seal of the United Kingdom to Ireland and Scotland, we are disposed to recommend that, for a patent extending over the United Kingdom, the Channel Islands, and the Colonies, a stamp of fifty pounds should be required.

But, if it should be thought inexpedient to debar inventors from taking out patents for England alone, in that case we recommend that a stamp of thirty pounds should be imposed on patents for England, with the Channel Islands and Colonies; with an addition of twenty pounds for Scotland and Ireland, or of ten pounds for either Scotland or Ireland separately.

We are inclined to believe that such an arrangement would afford satisfaction to patentees, and would, at the same time, compensate the revenue for the loss which it would sustain by the adoption of the course we have recommended.

We do not feel ourselves authorized to make any suggestions in regard to the proceedings before the Lord Chancellor.

We have, however, had our attention called to the subject of the specifications and their mode of enrolment, which is intended to be for the information of the public.

It is of great importance to a party applying to take out a patent for an invention to ascertain what patents in relation to the same object have been previously taken out; otherwise, after he has incurred considerable expense in perfecting his invention and obtaining a grant, some previous patent may be discovered which may vitiate his patent by destroying its originality.

For this, and other reasons, it would seem very desirable that specifications should be made more available to the public than they are at present.

It has already been stated that specifications have been hitherto enrolled in three different offices, searches in all of which must frequently be made before a party seeking to obtain a patent for a new invention can satisfy himself that no similar patent has at any time previously been granted; and, from the absence of indexes or proper classification, these searches must always be attended with great uncertainty, and often with great expense.

The difficulties of such a search are enhanced by the specifications being copied on rolls in an engrossing hand.

We are of opinion that these specifications should be entered in book-form in a common hand, and that proper indexes should be made of them. They would then become very valuable references for the public.

Another point to which we have had our attention very much directed, is the necessity of a patent going through three distinct and separate processes in order to be made available for the three kingdoms.

By the 24th article of the Act for the union of the two kingdoms of England and Scotland, 5 and 6 Anne, c. 8, it is enacted, "That a seal in Scotland after the Union be always kept and made use of in all things relating to private rights or grants, which have usually passed the Great Seal of Scotland, and which only concern offices, grants, commissions, and private rights within that kingdom."

By article 8, sec. 3, of the Act of Union with Ireland, 39 and 40 Geo. III., c. 67, it is enacted, "That the Great Seal of Ireland may, if His Majesty shall so think fit, after the Union, be used in like manner as before the Union, except where it is otherwise provided by the foregoing articles, within that part of the United Kingdom called Ireland."

These enactments preclude the Lord Chancellor, though Keeper of the Great Seal of the United Kingdom of Great Britain and Ireland, from granting a patent which can extend to Scotland or Ireland.

An inventor, therefore, in order to secure to himself the full benefit of his invention, must, in many cases, take out a patent under

each of the three Great Seals of England, Ireland, and Scotland; thereby, in addition to the increased trouble and delay, very considerably raising the expenses of his patent.

The fees and other charges incurred in taking out a patent for England, the Channel Islands, and the Colonies, amount, on an average, to about 150*l.* But in order to secure a patent for the three kingdoms, a patentee must incur an expenditure of probably three times that amount.

The following is the course pursued with regard to patents in Ireland and Scotland:

In Ireland.—1st. Petition to the Queen or to the Lord Lieutenant of Ireland. If to the Queen, it is referred to the Lord Lieutenant. In either case the petition is referred by the Lord Lieutenant to the Attorney-General for Ireland for report.

2nd. On the receipt of the Attorney-General's report a draft of a Queen's Letter is prepared and forwarded to the Home-office in London.

3rd. The Queen's Letter, which contains the authority for the grant, is signed by Her Majesty, countersigned by the Secretary of State, entered at the Signet Office, and sealed with the Signet, and returned to the Lord Lieutenant.

4th. On the receipt of the Queen's Letter, a warrant is prepared for the Lord Lieutenant's signature, directed to the Attorney or Solicitor-General, authorizing him to draw up a fiat containing a grant from the Queen to the parties applying.

5th. The fiat is submitted for his Excellency's signature, and the Privy Seal is affixed.

6th. It is forwarded to the Clerk of the Crown, who prepares the necessary document thereon, to be passed under the Great Seal of Ireland.

Caveats against grants of patents may be lodged with the Attorney or Solicitor-General for Ireland; but previously to a hearing, the opposing party is required to lodge 50*l.* to cover the expenses of the inquiry.

In Scotland.—1st. Petition to the Queen, which is left at the Home Office in London.

2nd. Reference of Petition to Lord Advocate of Scotland for report.

3rd. Report of Lord Advocate.

4th. Queen's Warrant, prepared at the Home Office, directing preparation of the patent.

5th. The patent is prepared in the office of the Director of Chancery, and carried at once to the office of the Keeper of the Great Seal, to have the seal affixed.

The same proceedings in regard to opposition take place before the Lord Advocate as before the Attorney or Solicitor-General at the first stage in England.

The annexed accounts will show the amount of fees and other charges payable on patents in England, Ireland, and in Scotland respectively. It will be observed that these accounts do not include the fees, &c., on the specifications, which vary according to the circumstances of each case.

It appears that previously to the passing of the Acts of Union, patents extending over the three kingdoms were sometimes passed under the Great Seal of England alone, and we see no real practical inconvenience which would arise from permitting such a course to be pursued at the present time.

We would suggest that all patents for new inventions might be granted as of course for the United Kingdom of Great Britain and Ireland, and that the proceedings for obtaining a patent should take place in this kingdom only. The specification in that case should be required to be enrolled in each of the three capitals.

The proceedings for a patent, whether in England, in Scotland, or in Ireland, must originate by petition to the Crown; and it would seem that Scotch and Irish inventors almost invariably take out patents in England, if not previously to, at all events immediately after, taking out their Scotch or Irish patent. The advantage, therefore, that would arise from the course recommended, in the saving of fees and other charges, and of time and trouble, would be at least as great to the Scotch and Irish patentee as to the English.

Cases, however, may occur in which it might be advisable to have the opinion of the crown lawyers in Ireland or in Scotland previously to Her Majesty being advised to grant her letters patent.

We would therefore suggest that, if it should be determined to give the power of granting patents under the single Great Seal of the United Kingdom, which should have effect in the three kingdoms equally, a discretionary power should be given to the Secretary of State, enabling him, should he see fit so to do, to refer the petition to either the Attorney or Solicitor-General for England, the Attorney-General for Ireland, or the Lord Advocate of Scotland.

If the views which we have formed with regard to the abolition of patents in some cases, and the simplification in all of the process of passing them, shall be approved of, the retention of the Signet Office as a distinct branch of the department of the Secretary of State will become unnecessary.

We therefore recommend that the Signet Office be abolished, and whatever business may remain to be transacted connected with

the Signet be transferred to the Home Office, together with such of the records, &c., now deposited in the Signet Office as may be necessary for the purposes of official reference. The remainder might be consigned to the custody of the Master of the Rolls, or to the State Paper Office.

The amount of business thus transferred to the Home Office could not be very considerable.

It would still be necessary to retain an establishment for the office of the Lord Privy Seal, though the duties of that office would be much reduced, and would not occupy the time of more than one clerk.

The business of the Signet and Privy Seal Offices is at present conducted in the same house in Abingdon-street, for which a rent is paid by the public. The abolition of the Signet Office would render the retention of this house unnecessary. If apartments could be provided for the future accommodation of the Lord Privy Seal's department in some one of the public buildings in Whitehall, it would be a great convenience in the transaction of the business of that office.

We think it desirable to refer to the Act of 1 Vic., c. 73, by which the Queen is enabled to confer certain powers and immunities on trading or other companies by means of letters patent.

The operation of that Act will not be in any way affected by the changes proposed in this Report, which have reference only to the mode of passing letters patent.

In concluding our Report, we beg leave to express a hope that the interests of individuals who may be affected by our recommendations and suggestions may be duly considered, and that compensation may be awarded to those whose tenure of office gives them a title to claim it.

MINTO.
G. CORNEWALL LEWIS.
H. RICH.

Dated this 30th day of January, 1849.

Extracts from Minutes of Evidence.

Joseph Clinton Robertson, Esq., examined.

Have you practised as a patent agent in London?—For upwards of 20 years.

The Committee understand that the nature of the business of a patent agent is to advise parties upon the obtaining patents, and to obtain the patents from the public offices?—Yes, to pass the patents through the public offices.

How many persons are there in the profession of patent agents?—About seven or eight.

What part of the business of a patent agent do you consider the most important; a knowledge of the scientific details, or an acquaintance with the practice of the public offices?—A knowledge of the scientific details decidedly. We have commonly to advise the party applying as to the invention which he supposes he has made being a fit subject for a patent, and as to its having been anticipated or not by previous patents; and these things require a very extensive knowledge of what has been done in patent matters, and in mechanical matters generally.

After the application for a patent has been made to the Crown, and sent to the office of the Secretary of State, it is remitted to the Attorney-General for his report, and at that stage of the proceeding, in case of opposition, a hearing takes place before the Attorney or Solicitor-General?—Yes.

Could you suggest any improvement in that stage of the proceeding?—None; so far as the reference to the Attorney-General is concerned.

You consider the mode of hearing the objections before the Attorney or Solicitor-General at the report is as satisfactory a form as possible?—I think that it is quite satisfactory, with this exception, that the Attorney-General has not the power, on a reference from the Secretary of State, to compel the attendance of witnesses and the production of papers, and this exception also, that he does not require the applicant in every case to deposit an outline of his invention before issuing the report. At present it is only in opposed cases that an outline specification is lodged, which is attended with this hardship, that a man who has the good fortune not to be opposed, gets through with an open patent (as it is called); he is not tied down to anything, and it is open to him during the six months allowed for specification to import into it anything which the words of the title, always vague and general enough for the purpose, will cover, though they may not have had any existence at the time of his application, and may not be of his own invention. He has an opportunity, in fact, of catching up anything that may come to his knowledge in the course of the six months; whereas another party who happens to be opposed is tied down to the outline specification which he lodges when he appears before the Attorney-General, or, at least, cannot travel much beyond it. It is a sort of skeleton description of his invention which he deposits, and all that is open to him is to fill it up.

You would require a similar outline specification to be deposited in all cases, and not merely in opposed cases?—Precisely so.

Assuming the report to be favourable,

and the patent to proceed, and that the warrant is sent from the office of the Secretary of State, a second hearing may take place at the Patent Bill Office, may it not?—Yes.

Does that stage appear to you to be of importance?—I think it is very inconvenient and uncalled for. I can see no reason why the report of the Attorney-General having been made in favour of the patent, that report should not at once go to the Great Seal.

Is there not an opportunity of lodging a special caveat at the Patent Bill Office?—Yes, a special caveat; that is, a caveat in which you must state not only the name of the patentee, but the title of the patent.

Could proper security be taken to guard the interests which are now protected by the special caveat, without allowing it to be entered at the Patent Bill Office?—I am not aware of any good which the protection does. It is attended with great inconvenience; for a man, after the hearing has taken place before the Attorney-General, may be opposed again by the same parties before the very same officer; and it is seldom that anything new comes out on the second opposition. It is generally a vexatious opposition at the Bill Office.

But a person opposes under a pecuniary risk?—Yes, he does; he deposits with his opposition 30*l.*, and he pays a large share of the expenses if his opposition is successful.

What is the interval of time that elapses between the hearing at the report, and the hearing at the Patent Bill Office?—It takes generally about three or four days to get the warrant for the bill, and it is very seldom that the bill is prepared in less time than six or seven days. There is apparently a very great deal of unnecessary delay here; I mean at the Bill Office.

Can a caveat be lodged at the Patent Bill Office up to the last moment when the bill is prepared?—Yes, until the bill is actually out of the office.

In fact, an interval of about ten days is allowed by the present system?—Yes.

Is there any advantage in passing a patent through the Signet Office?—No advantage whatever to the subject, and it causes a very great delay.

Is there any advantage in passing it through the Privy Seal Office? — None whatever.

Is a caveat ever entered at either of those offices?—It is open to enter one at the Privy Seal Office, but I have never known it done. It is understood that you might have a hearing before the Lord Privy Seal, but I have never known of such a case.

The patent is then sent to the Great Seal?—Yes.

A caveat may be lodged at the Great Seal, may it not?—Yes.

The Commissioners have been informed that few caveats are in fact lodged at the last stage?—There are not many, because it is in the power of the Lord Chancellor to impose costs on the opposing party, and in many instances such costs have amounted to a very heavy sum.

Is there any objection to the proceedings which take place at the last stage?—None whatever, except the heavy expense of all proceedings in Chancery.

Do you conceive that any advantages attend that stage?—I think it is very desirable to have the power of opposing up to the last stage, and I have availed myself of this opportunity frequently. When a case comes before the Attorney-General, his jurisdiction is limited to this extent, that he is not supposed to have the power of administering an oath, or compelling the production of papers: he can examine any party who appears voluntarily before him, or any documents voluntarily produced; but he cannot compel the attendance of a witness, or oblige him to produce anything; and it often happens that the Attorney-General feels himself thus embarrassed as to deciding a question, and avowedly makes his report upon the understanding that the parties will go and discuss the matter before the Lord Chancellor. We have had repeated instances of that kind.

Does it often happen that the Lord Chancellor refuses to seal the patent?—I have not known many cases of that kind. In the last case in which we were concerned, he allowed both patents to go out. The Lord Chancellor refers the matter back to the Attorney-General, who has then the power to administer an oath, and enforce the production of papers. The proceedings are then in Chancery. The Lord Chancellor very seldom goes into the question, but refers it to the Attorney-General, and the matter is generally settled before him.

Your opinion appears to be, that the essential steps in the proceeding are the reference from the Home Office to the Attorney or Solicitor-General at the report, and afterwards the reference at the Great Seal?—Yes; and if the Attorney-General had power at once in the first stage to take evidence upon oath, and to compel the attendance of witnesses and the production of papers, I should conceive that nothing further than that would be requisite.

Supposing the Attorney-General had this compulsory jurisdiction, do you think that one substantial stage at the report would be sufficient?—I think so.

At all events it would obviate proceedings

that now arise before the Lord Chancellor?—Entirely so. The matter now goes back to him to make up for that very defect in the proceedings.

According to that view, an application to the Crown would be made to the Secretary of State, and he would refer the petition to the Attorney-General for his opinion; and the Attorney-General, armed with the power of summoning witnesses and administering an oath, would investigate the matter, and if he reported in favour of the petition, the patent would be made out in the office of the Secretary of State, and would be issued in a complete form?—Yes; the warrant might pass from the Home Office at once to the Lord Chancellor to issue the patent, as is now the course pursued in the case of Scotch patents. I think that would be amply sufficient. It has been proposed that the Attorney-General should have an assisting committee of scientific men; but I think that would be attended with too much expense and difficulty; besides it would be always in the power of the Attorney-General to call in the assistance of scientific men when required. He could always send for third parties to advise with, as in fact he does now occasionally.

Do you think that the questions which come before the Attorney-General to report upon, are more of a legal than scientific nature?—It is almost invariably a combination of the two.

Are they questions which a lawyer or a scientific man is the most competent to decide?—I should much prefer the Attorney-General, after he has had a little experience. At first he is of course not so well acquainted with such matters; but after a short time I have seen no reason to be dissatisfied.

Does not a case frequently involve the construction of an existing specification?—Very frequently.

Upon questions of that sort, is not a lawyer more competent to judge than a scientific man?—No doubt; I should prefer the judgment of such an officer as the Attorney-General to that of any scientific man that could be proposed.

Do not you think that a lawyer is more competent to decide with the assistance of scientific men, than a scientific man with the assistance of lawyers?—Decidedly.

Do you see any advantage in the present system of a patent passing through a series of public offices?—None whatever. A great deal of delay is thereby occasioned, and often very great injustice; the more especially as there is only one day a week (Friday), when business can be transacted at the Privy Seal Office.

That is what is called sealing day?—Yes; and there is only one day in a week. You may indeed pay extra for a private seal on any day.

Do you see any advantage in the present length of letters patent?—None at all.

Do not you think it might be shortened without diminishing the security to the patentee?—I do not see any object to be gained by it. It is distinct enough, and clear enough.

Does not the length of an instrument multiply the chances of error in transcription?—I have scarcely ever known anything of the kind to occur. When any clerical error has been made in the course of transcription, it has been either in the name of the patentee, or in the title of the invention, and these are parts of the letters patent which would not be at all affected by abridging the length of the deed.

Do you think it advantageous that there should be a series of transcripts in successive public offices?—I think that the two transcripts in the Bill Office are attended with a very great deal of unnecessary expense. One is sent to the Privy Seal Office, and one to the Signet Office. That I suppose nearly doubles the expense; and there can be no doubt that the number of chances of errors must all be multiplied by the different stages the thing passes through.

In the same way, the more concise the letters patent were made, but being equally guarded in its provisions, the less expensive it would be?—Yes; but we have not met with any practical inconvenience from the length of the letters patent.

Assuming the amount of the public charges upon a patent to remain the same, do you think it would be better to levy them as at present, by a succession of fees, or to take them in one sum in the form of a stamp duty?—I think one sum as a stamp duty would be much preferable.

How would you charge the duty, in case a patent were abandoned before it reached the Great Seal?—That is a difficulty, certainly, in the way of substituting a single stamp duty.

Do you see any objection to charging a stamp duty upon the sealing of a patent, and paying the Attorney or Solicitor-General for the report by fees?—I see no objection to that. I think it would be desirable to secure the fees in the first place, because parties often commence a patent, and then abandon the proceedings; and if they were not bound to pay in the first instance, the experiment would be made so often, that it would be attended with great public inconvenience.

Would not that inconvenience be guarded against by requiring the fees of the Attor-

ney-General to be paid in the first instance, without reference to the sealing of the patent?—I think the Attorney-General ought to have his fees in any case. The fees of the English office are exceedingly moderate—they are not objected to at all.

(*To be continued in our next.*)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 2ND OF AUGUST, 1849.

ROBERT SHAW, of Portlaw, Waterford, cotton-spinner, and SAMUEL H. COTTAM, of Manchester, machinist. *For certain improved machinery for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials.* Patent dated January 25, 1849.

The improvements specified under this patent embrace a means of giving motion to the throstle-frames by bands or tapes passing over one or more cylinders, placed with their upper surfaces nearly on the same plane as the wharves of the spindles; an improved form of wharve; and certain arrangements connected with the headstock of the self-acting mule, whereby its motion may be regulated so as to give a greater or less twist to the thread.

WAKEFIELD PIM, of Kingston-upon-Hull, engineer and boiler-maker. *For certain improvements in propelling ships or vessels.* Patent dated January 25, 1849.

These improvements consist in having a screw or other propeller sunk into a recess or opening near to the bows of the vessel, which is to be connected either by the same shaft, or by the intervention of gearing, with the propeller, placed in the dead wood of the vessel near the stern.

Claim.—The application of two propellers used in conjunction, the one placed near to the bows, and the other near the stern of the vessel.

JAMES GREEN GIBSON, of Ardwicke, near Manchester, machinist. *For certain improvements in machines used for preparing to be spun and spinning cotton and other fibrous substances, and for preparing to be woven and weaving such substances when spun.* Patent dated January 27, 1849.

The principal novelties described in this specification are—

1. A small balance lever, over each of the two ends of which a single roving or slubbing slides in passing through the machinery. If any one of the two rovings happens to break, the lever gets turned over by the roving, which remains whole; and this action of the lever is made to stop the action of the machine.

2. A particular kind of cam for holding two rovings.

3. An expanding pulley, to be used instead of the ordinary cones, for varying the motion of the spinning machinery.

4. An arrangement to facilitate the use of two shuttles in the weaving of fabrics where two shuttles are used.

5. An arrangement for stopping the action of the loom when the shuttle is not properly boxed. And

6. An arrangement for stopping the action of the loom when any fault takes place in the lifting up of the weft.

PIERRE FREDERICK GOUGY, of Paris, France, gentleman. *For improvements in apparatus and machinery for lifting and moving heavy bodies, and for raising and displacing fluids.* Patent dated January 27, 1849.

Claims.—1. The employment of air for raising ships for purposes of repair.

2. Certain modes of raising ships for purposes of repair, by the rise and fall of the tides.

3. A mode of raising water.

4. The application of compressed air or carbonic acid gas for the purpose of raising malt-liquors and spirits, and also the means employed to regulate the pressure upon the liquor in the casks.

5. The application of compressed air to the working of garden engines and fountains.

6. The application of compressed and dilated air for raising water to supply warm baths.

7. The application of atmospheric pressure, in combination with the action of the tides, to empty dry docks.

8. Certain modes of dislodging masses of water or liquids from land hollows or from sewers, without cutting through the adjacent heights, and the applying of falls of water, artificially obtained by such mode or modes, to motive purposes.

9. A domestic hydraulic apparatus.

10. An arrangement of pumping apparatus.

11. The application of compressed air to the purpose of filtering fluids, or making extracts and essences. And

12. An apparatus for displacing fluids.

RICHARD ARCHIBALD BROOMAN, of the Patent-Office, 166, Fleet-street, London, patent agent. *For certain improvements in the manufacture of artificial limbs.* (Being a communication.) Patent dated January 27, 1849.

Claims.—1. An artificial leg, as described in the general arrangement, and adaptation of parts of which the same consists; that is to say, in so far as regards giving the thigh, at its lower part, a spherical shape,

so that the second joint, when adapted thereto, shall play over the said sphere when the joint is put in motion, without causing any seam or opening to be made between them.

2. The combination of the arm and spring with the thigh and second joint.

3. The shaping of the foot and ankle so that they shall produce, when put together, the peculiar joint described.

4. A method of attaching the toe-piece to the foot.

5. A spring for actuating the toe-piece and foot.

6. The tendon in the position in which it is made to operate.

7. A foot arrangement, independent of the thigh-piece, when such are to be applied where amputations are made below the knee. And

8. The metallic plates and bolts combining the thigh, leg, and foot at the articulations of the knee and ankle joints.

Ewald Riepe, Finsbury-square, Middlesex, merchant. *For improvements in the manufacture of soap.* (Partly communicated.) Patent dated January 30, 1849.

This invention consists in the application of carbonated alkali in manner following:—

A saponaceous glue is first formed with caustic alkaline lye, in as pure a state as possible, and its degree of saponification subsequently increased by the use of a stronger lye. Carbonated alkali, in a dry or calcined state, is then added in such quantity as that the amount of real alkali contained therein may equal the one-half of that in the saponaceous compound; and it is stated that the degree of concentration at which it is desirable the admixture should take place, is when a sample of the compound flows from a trowel in a coagulated state.

Claim.—The combination of carbonated alkali, as described, in the manufacture of soap.

William Kenworthy, Blackburn, Lancaster, cotton spinner. *For certain improvements in power-looms for weaving.* Patent dated January 31, 1849.

The patentee remarks; firstly, that although several contrivances have been invented by himself and partners to effect the stoppage of the taking-up-motion or coiling of the cloth when the weft breaks or fails, they have not hitherto been able to prevent the inconvenience arising from the catches being obliged to be lifted so repeatedly out of the teeth of the ratchet-wheel, to bring the cloth back to its original position, in consequence of its being coiled up several picks between the breakage or failure of the weft, and the stoppage; and, secondly, that the temples, at present in use for weaving strong fabrics, do not keep the selvages sufficiently distended. His invention has for object to remedy these disadvantages; and is as follows:—

1. The ratchet-wheel is attached to a drum, which is provided with an inside flange. The inner face of the wheel and of the flange have equidistant slots cut in them, the slots in the one being opposite the spaces of the other, constituting in effect an escapement-wheel. The two are keyed loosely upon a spindle, which carries at the outer end a pinion, and communicates motion through the intervention of toothed gearing to the taking-up beam. Upon the same spindle is a sliding clutch which is furnished with a radial arm, carrying at its upper end a pin, which projects to an equal distance on both sides, and is of somewhat greater length than the space between the two sets of slots, so that the pin is always in a slot of one or either of the sets. The clutch is slidden to and fro upon the spindle, by means of a clutch lever connected to a spring lever; and, consequently, the pin is made to move in and out of the slots in the wheel and the flange. When the loom is working, the spring lever is held back, and the pin caused to take into one of the slots of the flange and out of the wheel; but when the weft breaks or fails, the loom will be stopped by any well-known apparatus, and the spring lever thereby released, which will have the effect of thrusting the pin into one of the slots of the wheel, and of producing a recoil of the spindle equal to one-half the arc of one slot and blank, and, through the medium of the weight, a recoil of the taking-up beam in proportion to the toothed gearing. Mr. Kenworthy proposes, instead of the preceding arrangement of slots, to construct two rows of teeth upon the periphery of the wheel—the teeth of the one row being opposite the spaces of the other; and to substitute for the pin a blade, fixed on the radial arm, which is made to act in the same manner; or, to dispense with the drum, and to employ two pins attached to the radial arm, and inclined at such angles to the circumference of the wheel, as that one or other of the pins shall always be in one of the slots; or, to employ two reverse bevel wheels sliding upon a spindle, so that one of them may always gear into a third bevel wheel placed between them, and keyed upon a spindle which carries an endless screw that gears into a worm wheel keyed on to the axle of the taking-up beam; or, an arrangement of internal and external spur wheels, known as a "reversing motion," and well understood.

2. The improved temple consists of a combination of the nipper with the wheel or

roller temple. The wheel is provided with teeth or cards, and the cap for keeping the selvages down upon them, instead of being a fixture, is swivelled on a pin. A pair of jaws, having the inside surfaces serrated, are connected to it. The top one is fixed, and attached to a lever when the temple is working, while the lower one is moveable, and centred on the axle of the wheel. The jaws are kept closed by means of a spring pressing upon a bar attached to the lower one, except when its effect is destroyed at each stroke of the slay, and the jaws are then made to open. The lever is centred upon a pin, in order that when the shuttle strikes against the temple it may be moved out of the way.

Claims.—1. The employment of the escapement wheel, and radial arm in connection therewith, to produce a positive quantity of recoil of the taking-up beam.

2. The employment of the combination of the three bevelled wheels, or of the two external spur wheels and one internal spur wheel, commonly called "reversing motion," to effect a positive quantity of recoil of the taking-up beam.

3. The combination of the nipper with the wheel or roller temple, and the swivelled cap in connection therewith.

LEMUEL WELLMAN WRIGHT, Chalford, Gloucester, Civil Engineer. *For certain improvements in preparing various fibrous substances for spinning and in machinery, and apparatus connected therewith.* Patent dated January 30th, 1849.

These improvements refer to the treatment of flax and China grass, and have for object to free them from matting, and from gummy or colouring matters, by saturation in water and alkaline solutions, without the workman being obliged to remove them from one vessel to another. For this purpose the patentee proposes to employ two steam-tight vessels, connected together at top and bottom by pipes and cocks. The first vessel has an air-escape pipe in the top, a steam induction-pipe in the upper portion of the side, and an eduction-pipe at bottom. It is, moreover, provided with a perforated false bottom, inside, to which a hollow vertical cylinder, containing a piston-rod, is attached, and whereby the bottom is lifted out with the superjacent materials, through the medium of a crane, or other suitable mechanical means. Over the top of the material is placed a perforated plate, and above it a perforated shield, on which the alkaline solution or the water is caused to fall out of the pipe leading from the top of the second vessel, so that it may be equally distributed over the top surface. The second vessel is furnished on the top with an air-escape pipe, and communicates through the upper portion of the side, with the source of supply of the alkaline solution or water, and at bottom with a steam-generator.

The fibrous material is steeped in water for twenty-four hours, and then placed in fresh water, heated to 90° Fahr. for another twenty-four hours, after which it is placed on the perforated false bottom in the first vessel. Steam is made to pass into the second vessel, which contains an alkaline solution of a strength equal to 6° hygrometer, and is thereby heated, and caused to flow on to the material in the first vessel, and, after percolating through it, to return to the second one. The solution is thus used over and over again, until exhausted, when a fresh solution may be employed, if found necessary. Clear water is then made to flow through the fibrous materials, to cleanse them from any alkaline matter which may remain; after which steam is driven through them, for the purpose of drying them, and when that is partially effected, they are lifted out, and a fresh supply put in their place, and subjected to the same operation.

No claims are made in this specification.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Geeves, of Battle Bridge, Middlesex, saw-mill proprietor, for improvements in the manufacture of boxes for matches and other purposes. July 1; six months.

Julian Edward Disbrowe Rodgers, of High-street, Pimlico, professor of chemistry, for improvements in the manufacture of white lead. July 1; six months.

David Harcourt, of Birmingham, machinist, for improvements in vices, and in the manufacture of hinges, and also in apparatus for dressing and finishing articles made of metal. July 1; six months.

Adam Yule, of Dundee, master mariner, and John Chanter, of Lloyd's, London, gentleman, for improvements in the preparation of materials for coating ships and other vessels. July 1; six months.

Richard Kemsley Day, of Hatford, Essex, hydro-fuse manufacturer, for improvements in the manufacture of emery paper, emery cloth, and other scouring fabrics. July 1; six months.

George Fellows Harrington, of Portsmouth, dentist, for improvements in the manufacture of artificial teeth, and the beds and palates for teeth. August 1; six months.

Florentin Joseph De Cavaillon, of Paris, chemist, for certain improvements in obtaining carbonated hydrogen gas, and in applying the products resulting therefrom to various useful purposes. August 1; six months.

Eugene Alexandre Desire Boucher, of Rue des Vinaigriers, Paris, metal merchant, for certain improvements in the manufacture of cards. August 1; six months.

Jerome Andre Drieu, of Manchester, machinist, for certain improvements in the manufacture of wearing-apparel, and in the machinery or apparatus connected therewith. August 1; six months.

Benjamin Thompson, of Newcastle-upon-Tyne, civil engineer, for improvements in the manufacture of iron. August 1; six months.

Thomas Potts, of Birmingham, manufacturer,

for improvements in apparatus used with curtains, blinds, maps, and plans. August 1; six months.

John Shaw, of Glossop, Derby, musical instrument-maker, for certain improvements in air guns. August 1; six months.

Augustus Roehn, of Paris, gentleman, for improvements in making roads and ways, and in covering the floors of court yards, buildings, and other similar places. (Being a communication.) August 1; six months.

James Murdoch, of Staple's Inn, mechanical draughtsman, for certain improvements in converting sea water into fresh, and in ventilating ships and other vessels; applicable also to the evaporation of liquids, and to the concentration and crystallization of syrups and saline solutions. (Being a communication.) August 1; six months.

John Parkinson, of Bury, Lancaster, brass founder, for improvements in machinery or apparatus for measuring and registering the flow of liquids. August 1; six months.

Benjamin Aingworth, of Birmingham, button-maker, for improvements in ornamenting iron and other metals for use in the manufacturing of gun-barrels, and all other articles to which the same ornamented metals may be applied. August 1; six months.

David Clovis Knab, of Leicester-place, civil engineer, for an improved apparatus for distilling fatty and oily matters. August 1; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
July 26	1973	George Price	Birmingham	Stove.
30	1974	Sabina de Canlier	Coleman-street, City	"The Ottoman Cradle."
,,	1975	Miller and Co.	370, Oxford-street	Bedside or other table.
,,	1976	George West	Riccarton, Linlithgow	Tile machine.
Aug. 1	1977	Robert William Wright	39, Devonshire-street	Compound signet and keeper ring.

☞*A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the substance of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d.*

NOTICES TO CORRESPONDENTS.

"A. B. C." *is requested to send to our Office for a note addressed to him.*

CONTENTS OF THIS NUMBER.

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No. 1357.] SATURDAY, AUGUST 11, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

FISHER'S PATENT IMPROVEMENTS IN COKE OVENS.

Fig. 1. Fig. 2.

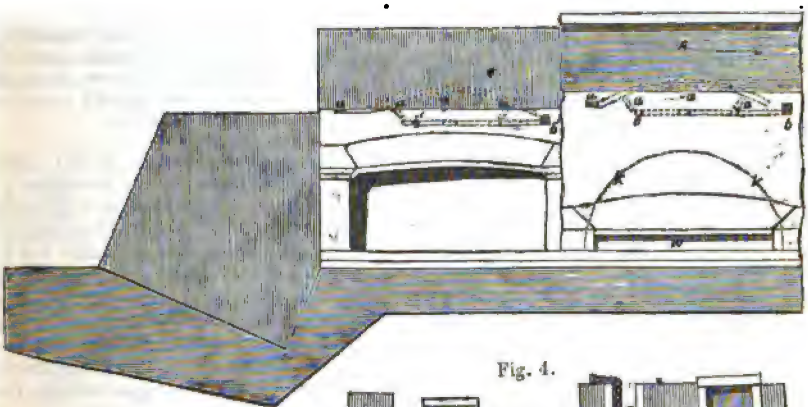


Fig. 4.

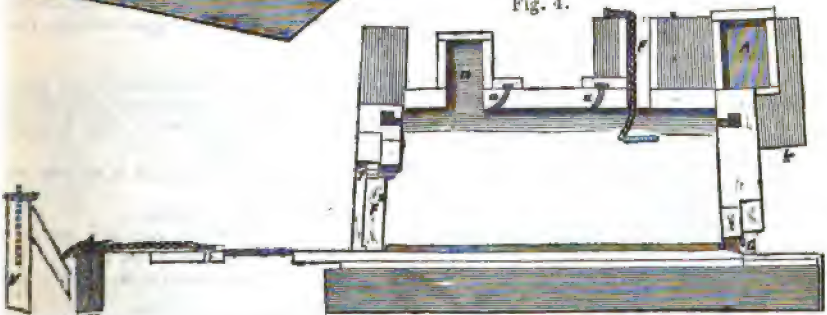
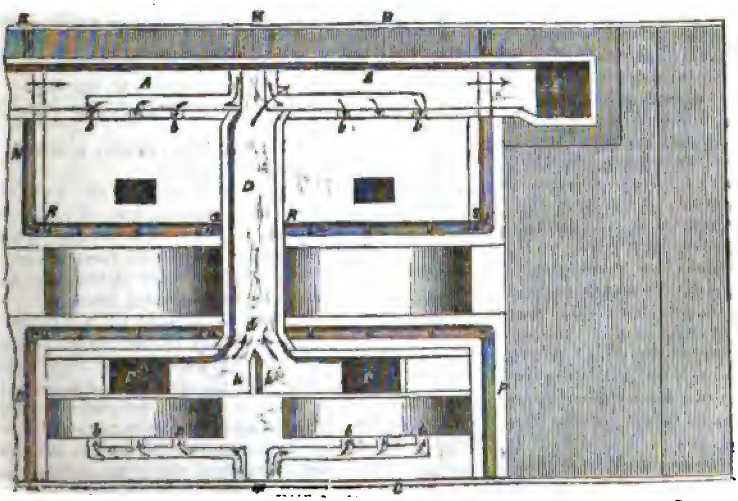


Fig. 3.



FISHER'S PATENT IMPROVEMENTS IN COKE OVENS.

[Patent dated February 8, 1849. Patentee, Mr. Henry Fisher, of Upholland, Lancashire. Specification enrolled August 8, 1849.]

MR. FISHER's specification is of great length, but the improvements which it describes are, with a few exceptions, of so practically useful a character, and likely to exercise so much influence on the future progress of the important branch of manufacture to which they relate, that we must endeavour to find room for it in full, with the omission merely of the formal parts.

The first branch of Mr. Fisher's improvements (to which we shall confine ourselves in the present Number) is introduced by the following general considerations:

As coke ovens are now commonly constructed, the air employed to keep up the combustion during the process of coking is admitted near to the surface of the burning mass, and though great pains are in some cases taken to diffuse it equally over the entire surface, yet owing to the close contact of the air with the coal, there is always a considerable portion of the air which combines with the solid carbon of the coal, and becomes thereby converted into carbonic acid and carbonic oxide, which escapes from the oven. Again; there is usually a very deficient supply of fresh air where it is most wanted, namely, immediately under the crown of the arch, where the gases accumulate; the consequence of which is that a considerable portion of these gases passes off unconsumed. From these different causes, there is always a great loss in the yield of coke produced from a given quantity of coal, and also a less quantity of coke manufactured in a given time from a given superficial area of oven. The quality of the coke produced is also impaired; for the hotter the oven, and the more the crude materials are kept from direct contact with the atmospheric air, the greater always is the yield and the denser and purer the coke. Moreover, the quantity of gases which escape in an unconsumed state from ovens into the atmosphere is frequently much increased by their being allowed to pass directly from each oven into the atmosphere. Attempts have been made to remedy this evil by causing a number of ovens to discharge themselves into one common flue terminating in a lofty chimney; but though by this means most of the gases are consumed before passing into the atmospheric air and a saving of heat is effected, yet the chimney produces an excessive draught from the ovens, and through all the air flues into the ovens, which is injurious to the quality of the coke, and causes a decreased yield from a given quantity of coal or slack. It is not more necessary to the production of good coke that the heat should be great than that the draft into and from each oven should be gentle, and equably maintained during the process of coking.

The object, therefore, of Mr. Fisher in this first branch of his invention is so to construct the oven that "there shall always be a due supply of atmospheric air admitted into the oven after the first ignition of the coal or slack, and that the bulk of the supply, shall be introduced at as great a distance as may be, from the ignited materials, and thereby completely combine with, and effect the perfect combustion of the gases arising from the same."

The better to accomplish these various objects, I construct the ovens in the manner represented in figs. 1 to 11, both inclusive of the figures annexed.

Fig. 1, is a front elevation of an oven with the door open.

Fig. 2, a back elevation.

Fig. 3, is a plan of two of a series of ovens, the same as figs. 1 and 2.

Fig. 4 is a longitudinal section on the line, B C, of fig. 3.

Fig. 5, a longitudinal section on the line, M M, of fig. 3.

Fig. 6, is a longitudinal section on the line, K L, of fig. 3.

Fig. 6^a, a transverse section of a single oven on the line, R S, of fig. 3.

Fig. 7, is a section on the line, N D, of fig. 3.

Figs. 8 and 9, represent a section on the line, O P, of fig. 3.

Fig. 10, is a view of the interior of the oven on a horizontal line above the door.

Fig. 10^a, is a view of the floor of the oven, with the door and back opening closed.

Fig. 11, is a view of the floor with the door and back opening open.

A, figs. 2, 3, 4, 5, 6, is the main flue, which is carried on the top of the back wall, and leads the gases arising from a series of ovens into the chimney; *a a*, (figs. 1, 2, 3, 4, 6, 6^a, 7, 8 and 9,) are passages which convey the air from the front and back of the oven over and down through the arch, into the interior of the oven, where the gases

arising from the coal or slack accumulate; b^1 b^1, b b, figs. 1, 2, 3, 4, 5, are air passages leading into the front and back of the oven; and k, figs. 2, 4, is an arch under the back wall of the oven.

M M M, (figs. 3, 5, 6, 7, 8, 9,) are the piers which divide the ovens. D, figs. 3, 5, 6ᵃ, 7; and 8 and 9, is a discharge flue, which runs along the top of each alternate pier, immediately above the spring of the arch, and is common to the two adjoining ovens; c c, figs. 3, 4, 8 and 9, are passages which convey the used gases from each pair of ovens into other passages, h h, figs. 3, 5, which terminate at d, (fig. 3,) where they open into the common discharge-flue, D; l, (fig. 5) is an air-hole for admitting air into D. (A similar longitudinal discharge flue, D, may be also applied to single ovens, in order to obviate the necessity for a tall chimney.)

F (figs. 4, 7) is the aperture in the top of

Fig. 5.

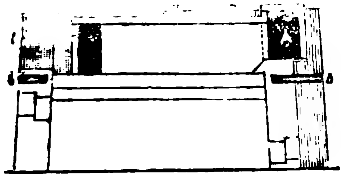


Fig. 6.

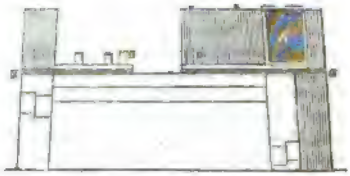
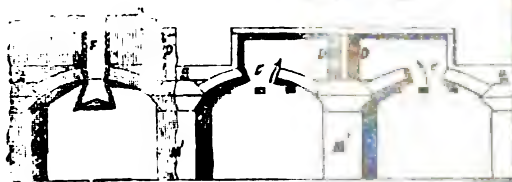


Fig. 7. Fig. 8. Fig. 9.



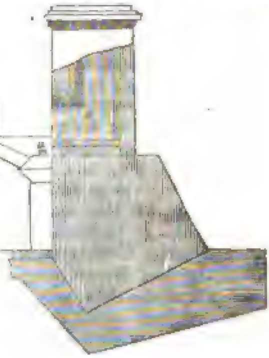


Fig. 6ᵃ.

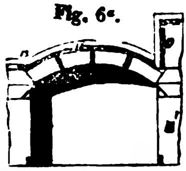


Fig. 11.

Fig. 10.

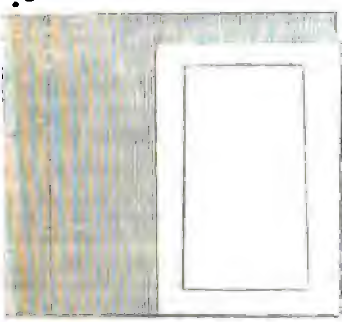
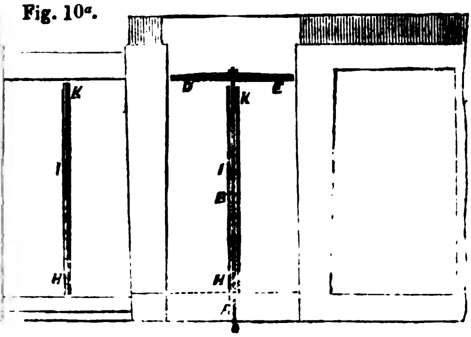


Fig. 10ᵃ.



each oven, through which it is charged with coal or slack, according to the plan for which letters patent were granted to John Cox on the 21st day of November, 1840, as the same has been improved by me in the manner described under the second head of this specification.

E, (figs. 3, 8 and 9) is the chimney.

F *f*, (fig. 4) are the tiles and bricks which close the door in front of the oven, and G, those which close it at the back.

The principal peculiarities in the construction of these ovens (so far as regards this first head of my invention), to which I lay claim, are—*First*, the auxiliary air-passages, *a a*, which convey the air through the arch into the interior of the oven at the top, where the gases accumulate, and where direct contact with the crude or burning materials is impossible; and, *Second*, the discharge-flue, D, common to every two ovens of a series, which does away with the necessity for the lofty chimney ordinarily attached to coke ovens.

The dimensions which I find most suitable in practice for these improved ovens, are the following: viz., width in front, 7 feet, gradually diminishing to 6½ feet at the back; height from the floor to the spring of the arch about 4½ feet, and versed sine of the arch over the oven about 10 inches. But I vary these dimensions according to the kind of coal to be coked, and sometimes form the oven throughout of the same width as the door. The sides of the arch being parallel, I make the front and back openings of the entire width of the oven at front and back respectively, or nearly so.

The air-flues, *a a*, and *b b*, are represented in the engravings as being formed in alternate piers, but they may be formed in the same pier if preferred, without any material prejudice to the system of action.

When the coal is sufficiently ignited, I sometimes diminish the supply of air through the front and back openings (b^1 b^1 and *b. b*) and depend mainly for a supply of air from the top flues, *a a*, through the arch.

(*To be continued in our next.*)

ON CERTAIN RESEARCHES OF MR. BOOLE, AND THE SYMBOL OF INFINITY.

Sir,—To your distinguished correspondent, Mr. George Boole, of Lincoln, I have to express my thanks for the courteous and interesting communication in which, at pages 254-5 of the 49th volume of the *Mechanics' Magazine*, he has been pleased to notice some remarks on his logical writings which I made at page 79 of the same volume. It is not my wish or intention to prolong a discussion which might have the effect of distracting Mr. Boole's attention from other investigations; but I shall be permitted to suggest that it may be a question whether we may not as truly say that Kant has based metaphysic on logic, as that he has founded logic on metaphysic.

My present object is, however, connected with Mr. Boole's observations on the "Laws of Quaternions," at page 280 of the 33rd volume of the *Philosophical Magazine* (Ser. iii.) He has there shown that the quaternion relations

$$i^2 = j^2 = k^2 = -1$$
$$ij = k, jk = i, ki = j,$$

when considered as of universal application conduct us to the conditions

$$ji = -k, kj = -i, ik = -j,$$

and thus lead to a sacrifice of the commutative character of multiplication. It becomes therefore a subject of inquiry whether the fundamental equations of my Tessarine System* entail upon us the necessity of any such sacrifice. To ascertain this, I shall apply the method of Mr. Boole to the Tessarine conditions

$$i'^2 = -j'^2 = k'^2 = -1$$
$$i'j' = k', j'k' = i', k'i' = -j'.$$

Let, then, the subjectof operation be $j'y$, and we have

$$i'j'\, j'y = k'j'y$$

or $$i'j'^2y = k'j'y$$

but $$j'^2 = 1,$$

therefore $$i'y = k'j'y.$$

So, if the subject be kz, we have

$$j'k'\, k'z = i'k'z,$$

or $$j'k'^2z = -j'z = i'k'z;$$

and, proceeding thus, we see that the commutative character of multiplication is preserved in the Tessarine Theory.

Before concluding, I wish to call attention to a point respecting the symbol of *infinity*. It has been observed by Dr. Peacock at pp. 237, *et seq.* of the third *Report* of the British Association, that this symbol may denote *impossibility*. Why is this? Perhaps the fol-

* On the subject of the Theory of Tessarines, I would refer the reader to previous papers in this Journal, and also to the following articles in the *Phil. Mag.* (Third Series).

1. On certain Functions resembling Quaternions, and on a new Imaginary in Algebra. *Phil. Mag.*, s. iii., vol. xxxiii., pp. 435—439.
2. On a new Imaginary in Algebra. *Ibid*, vol. xxxiv., pp. 37—47.
3. Solution of two Geometrical Problems. *Ibid*, pp. 132—135.
4. On the Symbols of Algebra, and on the Theory of Tessarines. *Ibid*, pp. 406—410.

The reader is also particularly referred to the *Errata* to the last cited volume of the *Phil. Mag.*

lowing remark may have some bearing on the question.

Consider the two equations

$$0=\sqrt{x}+\sqrt{x+1}$$

$$0=\sqrt{x}-\sqrt{x+1}.$$

The first of these is evidently *impossible*. The second is satisfied by the value

$$x=\infty;$$

but, on multiplying the two equations together, we are conducted to the result

$$0=-1.$$

In other words, although one of the above congeneric surd equations is satisfied by $x=\infty$, the rational equation which is the product of the two is numerical incongruity.

I am, Sir, yours, &c.,

JAMES COCKLE.

2, Church-yard Court, Temple, August 6, 1849.

ON THE TIMES IN WHICH A SUM OF MONEY WILL DOUBLE ITSELF.

Let P be the principal.

i the interest of 1*l.* for one year.

S the amount.

n the number of years.

m the number of payments in a year.

Then $(1+i)$ is the amount of 1*l.* in one year, when the interest is payable annually; and $\left(1+\frac{i}{m}\right)^m$ is that amount when the interest is payable m times a year.

By known theorems, when the interest is payable yearly,

$$S=P\,(1+i)^n\ :\ \text{but } S=2P\ \therefore\ 2P=P.\,(1+i)^n.$$

$$\text{or } 2=(1+2)^n.$$

$$\text{and log. } 2=n.\ \text{log. } (1+i)$$

$$\therefore\ n=\frac{\text{log. } 2}{\text{log. } (1+i)}$$

Similarly when the interest is payable m times a year, we have

$$n=\frac{\text{log. } 2}{m\left(\text{log.}(1+\frac{2}{m}\right)}.$$

Hence if a sum of money be put out at interest, and the interest be convertible into capital at the time it becomes due, the sum will double itself in the times shown below under the specified conditions :—

			Years.
At 5 per cent., payable yearly, it will double itself in			14,2067
,,	half-yearly	,,	14,0355
,,	quarterly	,,	13,9494
At 4½ per cent., payable yearly,		,,	15,7473
,,	half-yearly	,,	15,5759
,,	quarterly	,,	15,4897
At 4 per cent., payable yearly,		,,	17,6730
,,	half-yearly	,,	17,5014
,,	quarterly	,,	17,4150
At 3½ per cent., payable yearly,		,,	20,1488
,,	half-yearly	,,	19,9770
,,	quarterly	,,	19,8907
At 3 per cent., payable yearly,		,,	23,4498
,,	half-yearly	,,	23,2779
,,	quarterly	,,	23,1914

The preceding results have been obtained by the application of the above expres-

sions; it is considered that they may occasionally be useful to the man of business, at all events, they afford a profitable exercise for the young arithmetician to test their accuracy. θ. φ.

Exeter, July 31, 1849.

THE INVENTION OF THE DREDGING-MACHINE.

In reading over Mr. de Chesnel's paper in the *Mechanics' Magazine*, No. 1150, 23rd of August, 1845, wherein documents are brought forward proving incontestibly that the Steam-dredging Machine was invented, and first put to use by Sir Samuel Bentham, not as has been asserted by Mr. Rennie, it appears that an important and a published document has been omitted by Mr. de Chesnel, namely, one addressed 25th of April, 1801, to Charles Abbott, Esq., Chairman of the Select Committee of the House of Commons, for the further improvement of the Port of London. That Committee had requested Sir Samuel's opinion on the subject of a projected bridge: after having given his ideas on the subject of the bridge, he added, that he "would farther take the liberty of offering some observations respecting other objects of improvement which appear to be under consideration;" and continued thus,—

"First, with regard to deepening the river. The eligibility of all the plans for the improvement of the navigation of it, as well as for the making new embankments, seems to depend greatly on the cost and expedition with which the operations can be carried on of digging under water, and of depositing the soil taken up: so much so, that the coming to a decision on just grounds, respecting the preference to be given to one or other of the plans before the Committee, seems to require that the rate of expense and time necessary for the deepening, and for the subsequent cleansing of the river should be first ascertained. On this head I would observe, that having had under consideration several proposals from others in reference from the Admiralty Board, as well as plans of my own for the improvement of some of our naval ports, the expediency of all of which plans, depends more or less on the expense at which digging under water can be effected, and finding the tardiness, as well as the enormous expense of doing this business by means of the ordinary ballast lighters, to stand as a barrier against any attempts at improvement by these means, this expense being at Portsmouth, 2*s.* 6*d.* a ton, including the carrying away the soil, I have been induced to contrive an apparatus for digging under water by means of a steam engine. Such an apparatus is in consequence preparing, by order of the Admiralty, for the use of Portsmouth Harbour; and whenever that one shall be so far completed, as for its efficiency to be ascertained, I should suppose that others would be ordered for the improvement of the navigation of the Thames and Medway, in as far as his Majesty's dock-yards are concerned. In the mean time, though I have no doubt that some farther improvements will suggest themselves in the course of the first experiments with this engine, I take the liberty of sending copies of drawings of this apparatus such as it is at present preparing. The expense of the whole apparatus, including four barges of about 200 tons each for carrying away and depositing the soil, two of them for depositing it in deep water, the others at about the surface of the water, was estimated at 4,700*l.* It is calculated that by this means about one thousand tons may be raised and deposited in a day, at an expense (including interest of the money laid out on the machinery of it, labour and fuel) of about twopence a ton."

The above communication was printed, together with other papers relative to the Port of London, by the order of the House of Commons.

Thus it appears, that not only were detailed drawings of Sir Samuel's steam-dredging machine laid before the Admiralty, 13th of May, 1806, as Mr. de Chesnel has stated; but farther, that copies of these drawings were sent to the Committee of the House of Commons, in May of the year preceding that in which Mr. Rennie first proposed a steam-dredging machine. Publicity having thus been given to Sir Samuel's invention, it is not impossible but that Mr. Rennie might have had access to those drawings in the year before the time of his first proposal of such an apparatus.

Notwithstanding Sir Samuel's supposition, that improvements of his first machine would present themselves, it is remarkable, that none such have been made in the half century during which this invention has been in such extensive use, for, so far as can be learnt from printed statements, no modification of Sir Samuel's machine has ever surpassed it in the excellence of the work done, and it does not appear, that any one has equalled it, in the low rate at which by its means, soil from under water can be raised.

NEEDHAM'S PATENT IMPROVEMENTS IN FIRE-ARMS.

[Patent dated July 20, 1849.]

Fig. 1.

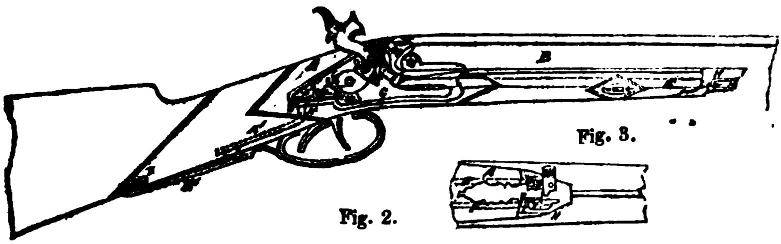
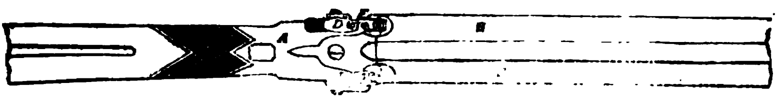


Fig. 3.

Fig. 2.



Mr. Needham's improvements in fire-arms consist — *Firstly*, Of certain additions to the stock and lock of muskets and fowling-pieces, whereby every time the fire-arm is loaded and the hammer pulled back to full cock, preparatory to firing, a percussion cap is taken from a reserve or magazine formed in the stock and placed upon the nipple of the lock, and the necessity of performing that operation by hand is thus avoided.

Fig. 1, is a part side elevation of a double-barrelled fowling-piece, fitted with these additions, and fig. 2, is a plan of the same. A is the stock; B B, are the barrels; C, is the plate of the lock; D, the hammer, or cock; E, is a cap-charger, which is affixed to the plate of the lock, and moves backwards and forwards within a recess, *e*, made for it in the plate. On the inside of the cock there is a small projecting pin, *a*, which takes into a cleft, *b*, in the lower end of the charger, E, but has no action upon it till the hammer is drawn back from half cock to full cock, when the action of the pin causes the charger to move forward to the position in which it is represented in the engraving, (fig. 1,) namely, immediately over the nipple. F F, are channels in the stock (one to each barrel), which form the reserves or magazines for the percussion caps, (only one of these channels is seen in fig. 1). These channels may be either cut out of the wood or formed by inserting small metal pipes into the wood, and, in either case, they should be a very little larger than the diameter of the percussion caps, so that while the caps have perfect freedom to pass along the channels, they shall not be able to turn in it end over end. Fig. 3, is a plan of that part of the stock where the channels, F F, terminate towards the muzzle of the piece. G G, are rectangular openings, by which the caps are introduced into the channels, F F, and *c c*, small guide-pins which project obliquely into these openings and render it impossible to put the caps in any other than the proper way into the channels.

The number of caps contained in these channels or reserves will vary with the length of the stock, but guns with the ordinary length of stock will contain more than is sufficient for a single day's shooting; H H, are spring covers to the openings, G G.

When the charge is being inserted into the piece, the position in which it is held causes the caps in the channels to gravitate towards the lock, and as the channel terminates at the upper edge of the plate of the lock, just before the mouth of the cap-charger, the last or lowest of the series of caps drops into the charger. The hammer is supposed to be down upon the nipple at

this instant, but the charge having been put into the barrel the hammer is then brought to half-cock, in which position it retains the cap in the place in the charger, into which it had dropped. When the piece is to be fired off, the drawing up of the hammer causes the charger to move forward and put a cap upon the nipple, yet without pressing it down so far as to cause an explosion to take place. On drawing the trigger, the cap-charger instantly recedes back into its place under the hammer, ready to take up and supply another cap when the piece is again charged.

From the description which has been thus given, it will be obvious that the charger, instead of being placed outside of the plate of the lock, might be placed inside; but this is an arrangement which Mr. Needham does not recommend, as it would cause openings to be left in the interior of the lock, through which it might very soon become foul. The charger instead also of being put in motion from the hammer, might be directly connected with the tumbler, or might be acted upon by the ramrod of the gun, so that when the ramrod was inserted into its place it should cause the charger to bring a cap over upon the nipple. These plans are mentioned to show how the charger may be acted upon so as to perform the office it is intended to fulfil, but they are considered less efficient than the method first described.

Secondly. Mr. Needham's invention has for its object the rendering of fire-arms more safe while being handled, and consists of a safety-lock, the parts peculiar to which are represented in dotted lines in fig. 1. A^1 is a lever which is joined by a hinge joint to the butt of the stock at B^2, and towards the lock is sunk in a recess in the stock. The free end of the lever, A^1, abuts against a pin, *g*, projecting from another short lever, C^2, which has its axis fixed upon the plate of the lock. The lever, C^2, is kept pressing up against the tumbler, T, by means of a spring, D^2, and by taking into the first vent, *f*, of the tumbler, prevents the hammer from coming down upon the percussion cap. In grasping the piece by the hand to fire it off, the hand necessarily presses upon the lever, A^1, and allows the hammer to come freely down upon the nipple. Consequently, the gun or piece cannot be fired unless both the lever, A^1, and the trigger are acted upon, and this done at one and the same time.

Claims.—I claim the combination of the hammer with a percussion cap-charger, in the manner before described, whereby every time the hammer is drawn back to full cock the charger moves forwards and puts a percussion cap upon the nipple.

Second. I claim the forming of channels in the forepart of the stock for holding percussion caps, having rectangular openings and guide-pins, as before described.

And, *Third*, I claim the safety-lock, before described, in so far as regards the parts indicated in dotted lines in fig. 1.

THE SEVEN LAMPS OF ARCHITECTURE. BY JOHN RUSKIN, AUTHOR OF "MODERN PAINTERS." LONDON, 1849.

Coming from the pen of one whose "Modern Painters" has earned for him the reputation of an original, and acute critic in art, this new production has obtained far more notice from the reviewing craft than usually falls to the lot of books on the subject of architecture. For this it is, no doubt, partly indebted to the fancifulness of its title, and the singularity of its style. In these respects it certainly deserves to be called, as it has been, "a very remarkable book;" though, for our own parts, we have but a small corner in our toleration for mannerism of any sort, and least of all for such mannerism as Mr. Ruskin delights in. He would be thought a man of fine feelings and lively emotions; but only plays the part after the fashion of the Bombastes' of the stage, and Mawworms of the conventicle. The pith of his discourse lies in exaggeration; in saying odd and absurd things in a fantastic way. He appears uniformly far more attentive to manner than to matter; and in some places wraps up his meaning in such mystical language as to be wholly unintelligible. It would require thrice "Seven Lamps" to throw a glimmering of meaning upon such passages, for example, as the following, in which he undertakes to *explain* (!) what picturesqueness means: "The picturesque *is developed distinctively, exactly, in proportion to the distance from the centre of thought of those points of character in which the sublimity is found!*" The italics, which are Mr. Ruskin's own, are of course intended to impress some momentous piece of æsthetic doctrine upo the reader; but what its meaning may be no one can tell—not even, we suspect, the author himself.

The high, not to say extravagant commendations which Mr. Ruskin has obtained from most of those who have spoken of his "Seven Lamps" are, it may be presumed, perfectly sincere and spontaneous, because, so far from falling in with, and flattering popular notions and prejudices, he often runs quite counter to established opinions and existing interests. He vituperates railroads and railway travelling; sneers at shop-front decoration; strongly protests against the wholesale mushroom erections of building speculators; is quite furious against the use of factitious materials, and cast or machine-wrought ornaments; and is anything but national in his architectural sympathies—extolling mediæval art to the skies, but that chiefly which has flourished under the "blue serene" of Italy, and consigning the Gothic style of our hyperborean regions ("our detestable perpendicular," as he calls it,) to everlasting infamy.

In much of this there is palpable affectation. Mr. Ruskin has fallen into the great error of confounding mere difference of opinion with originality. It is easy to differ from the recorded judgments of persons recognised for ages as authorities in art and science; not always so easy to give a sufficient reason for the differences. The original thinker is he only, who sees farther or better than those who have preceded him—not he who merely fancies the weasel to be "very like a whale." We cannot be expected to discuss here the many heresies in constructive art of which Mr. Ruskin is guilty; it would be quite foreign, indeed, to the purposes of this Journal to do so; but one of these which we have just cited falls so directly within our special province, as to provoke irresistibly a few remarks.

We allude to Mr. Ruskin's denunciation of "cast or machine-wrought ornaments;" in which he evidently points to the large share which the admirable wood and stone carving machinery of Mr. Jordan has had in the embellishment of the New Palace at Westminster. Mr. Ruskin can see beauty in no ornament which does not display the *living* hand. With him all cutting is bad cutting which is effected by machinery, or is, to use a phrase of his own, "deadly cut;" all pains, cold, lifeless, and heartless, which does not bear the palpable marks of having been directly bestowed by some hand instinct with life. If there be any sense or rationality in this, then we ought for consistency sake to place, in the same category with machine-produced architectural ornaments, every other product of the arts of moulding and casting—call for a revival of the times of written and illuminated books—throw all our types, and woodcuts, and engraved plates into the sea,—melt down all our best coins and medals,—and make a grand bonfire of all our type-cast science and literature, the "Seven Lamps" included. Such doctrine requires only to be followed out to its legitimate consequences to be utterly demolished.

Some truth there is in what Mr. Ruskin says about the "look of equal trouble everywhere apparent" in machine-produced decoration; but that is an objection which applies just as forcibly to hand-work. No doubt there is in all architectural decoration a very needless equality of pains bestowed. A building should *appear* to be equally finished throughout, yet the degree of actual finish bestowed on its several features should be regulated according to their situation and distance from the eye. All that comes within the scope of close inspection should, of course, be carefully finished up, whereas the same degree of finish becomes quite thrown away on the upper parts of a lofty building, where even rude and coarse, but artistic touches, would *tell* infinitely better than the most delicate workmanship. Scene-painters understand working for *artistic effect* much better than architects appear to do. With their *daubing*, as it is frequently called, they express far more than they possibly could do, by finishing up their productions like easel or cabinet pictures. The besetting sin of our architects is, that they do not sufficiently study effect, or do not make due allowance, as the scene-painter does, for the altered appearance occasioned by distance, and for what is either gained or lost thereby. The appearance answers

all the purpose of "elaboration" itself in those parts and details which are removed from close inspection; and to be able to produce such appearance, without superfluous cost and ill-bestowed labour, shows real skill and artistic ability on the part of an architect. The work of the mason or moulder, though performed by hand, is, for the most part, done quite as mechanically as it would be by a machine. Nay, according to present practice, the details of a building require, even on the part of the architect himself, very little more than to copy correctly what was originally shaped out and produced by positive design,—by the exercise of invention, and by careful study of effect, and of what particular purposes and occasions expressly demand. Now-a-days, on the contrary, any exercise of artistic freedom, instead of being at all encouraged, is reprobated as licentious—at least, by your straight-laced *precedent* gentry, who are equally micrological in taste and microscopical in vision.

Mr. Ruskin makes no express mention in his book of the New Palace of Westminster; but in other instances besides that which we have already noticed, his remarks seem evidently levelled against it; at any rate, they hit it palpably enough. It is the greatest modern example of that style which Mr. Ruskin is pleased to call the "detestable perpendicular." To that style he will allow no merit whatever, regarding it as no better than a degradation and corruption of the Gothic previously employed. In this opinion we ourselves do not at all hold with him; for it appears to us to possess many beauties and merits peculiarly its own, and to be, withal, more manageable for modern purposes than the ecclesiastical Gothic. Both that and the later "Tudor" styles have much of the palatial in their character, —at least contain elements which may be made highly conducive to palatial grandeur and richness. Still, Mr. Ruskin will tolerate neither; for, besides calling the perpendicular style "detestable," he expressly says of the other, that he has "always spoken of it with contempt." And in speaking of it now, he employs what is certainly a most scurvy comparison, saying, that "it adopts for its leading feature (characteristic) an entanglement of cross bars and verticals, showing about as much invention or skill of design as a bricklayer's sieve." Smart words, but nothing more. Mr. Ruskin does not furnish a single artistic ground for objecting to the intersection of vertical and horizontal mouldings. That, like any other characteristic mode of ornamentation belonging to a style, it may be, and perhaps frequently has been carried to excess, is not to be denied; but then it is the *excess*, and not the mode itself, which is to be condemned.

Mr. Ruskin is such a lover of "pure nature," in what we may call the *cant* sense of the term, that he even objects to the letters of the alphabet on that account!—"Of all things unlike nature, the forms of letters are perhaps the most so." But here our author has made a sad slip. For though he thus in one part of his work denounces letters for their unnaturalness, he elsewhere recommends inscriptions as very appropriate for the fronts of even dwelling-houses. It may be said, "Oh, but he means that such inscriptions should have *no letters* in them?" Perhaps so.

The only modern building which Mr. Ruskin regards with favour, or condescends to mention at all, is the British Museum, and for the same reason, apparently, which influences most of his other judgments—*everybody else condemns it*. But here, again, he is guilty of a very gross inconsistency; for the Museum, as all the world knows, is in the Grecian style, and Sir Robert Smirke is the greatest modern adapter of that style. And yet it is in such terms as these Mr. Ruskin speaks elsewhere of Sir Robert's labours:—"I cannot conceive any one insane enough to project the vulgarization of Greek architecture." Thus, though he gives Sir Robert Smirke a friendly pat on the cheek on one side of his face, he gives him also a confoundedly heavy box o' the ear on the other—because, from first to last, Sir Robert has dealt in the "vulgarization of Greek architecture," applying it in the most mechanical manner possible, to every purpose imaginable.

What it is that especially excites Mr. Ruskin's "sincere admiration" of the British Museum, we are left to guess; for, as usual with him, he is content to be singular in his opinion without offering any good reason for it. Mr. Ruskin's ambition is to be considered as the Longinus of his day; but he is no more than a tolerable "Sir Oracle."

BAIN'S ELECTRO-CHEMICAL PRINTING TELEGRAPH.

A highly interesting exhibition took place last week at the Hôtel Victoria, Paris, of the new system of electric telegraph invented by Mr. Bain, who is at this time superintending the laying down of 1,600 miles of telegraph on his new principle in the United States. Mr. Bain's apparatus was exhibited and ably explained by Mr. W. Baddeley, who came from London for the purpose. By this discovery the rapidity of communication is increased from 65 letters, or about nine words, to 1,000 letters per minute. Mr. Baddeley was visited by nearly two hundred men of science, and gentlemen connected with the Government Railroad Companies, &c.—*Galignani's Messenger.*

[Mr. Bain's Telegraph has been for some time past working between Washington and Philadelphia, where it has given the greatest satisfaction. Arrangements are now making for its employment by the Electric Telegraph Company in London, who have purchased Mr. Bain's patents for Great Britain. ED. M M.]

STELLING'S PROCESS OF MAKING AMBER VARNISH.

In manufacturing amber varnish according to Mr. Stelling's method, the amber (which has to be submitted to high temperature to melt it) is introduced into a stout copper vessel, which is closed at top and luted with clay. This vessel is furnished at its lower end with a funnel-shaped vent, which carries a perforated sheet of iron or sieve, sufficiently fine to prevent the escape with the melted amber of any impurities which might be contained in the amber. This vessel is introduced into a large chafing-dish fixed upon a high stand, and its tapering bottom projects through a hole in the bottom of the chafing-dish, and extends a few inches downwards. When the vessel is thus adjusted, the chafing-dish is nearly filled with coal and lighted. The fuel is, by the peculiar form of the chafing-dish, prevented from dropping into the oil vessel, to be presently described, and thereby soiling the liquid.

The heat from the ignited fuel very soon heats the vessel to such a temperature as will melt the amber and cause it to flow through the perforated metal or sieve above mentioned, in passing through which it will be purified from all extraneous matters. The melted amber runs into a copper vessel which is placed below the chafing-dish, and is provided with a long handle. This vessel or receiver is filled about two-thirds full with the oil from which it is intended to prepare the varnish, and is placed upon an ordinary chafing-dish charged with incandescent fuel, which heats the amber to such a temperature as to cause it to become incorporated with the oil. When this is completely effected, the vessel is cleansed for a fresh operation, and the other ingredients necessary for the manufacture of the varnish are added to the mixture of oil and amber, as soon as it has cooled down to a suitable temperature.

These very simple means present the following important advantages over those now in use for the manufacture of varnishes:—

1st. The amber melts completely without any residuum; and as it is contained in a perfectly tight vessel, nothing, or next to nothing, is lost by the evaporation of its constituent parts.

2nd. The application of a high temperature effects the fusion with ease and rapidity.

3rd. This mode of preparing varnishes is perfectly free from danger, as regards fire. The amber is contained in a perfectly close vessel, and cannot, therefore, take fire, especially as the air has no access through the spout through which the melted amber flows. Neither will the oil through which the melted amber flows be liable to take fire, for it does not require to be heated to a very high temperature, as is at present the practice,—the amber being now melted and dissolved in oil heated to the point of violent ebullition; and further, the chafing-dish is small, and it is impossible it can communicate to the vessel filled with oil (which is of much more considerable capacity) sufficient heat to cause fear of fire.

4th. All the vessels are of stout copper, and consequently are not liable to burst, as is the case with the earthen ones, which are at present too often employed.

It will thus be seen that, independently of the practical advantages which this method of manufacturing varnish (and which has already stood the test of long experience) possesses over those ordinarily in use, it has the important one of being unattended with danger.—*The Technologiste, as translated in the London Journal.*

HEATING FLUIDS BY THE CIRCULATION OF HEATED METAL IN PIPES.

Fig. 1.

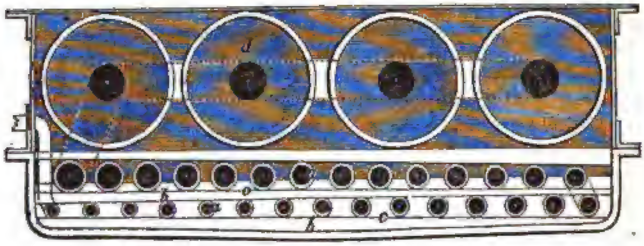
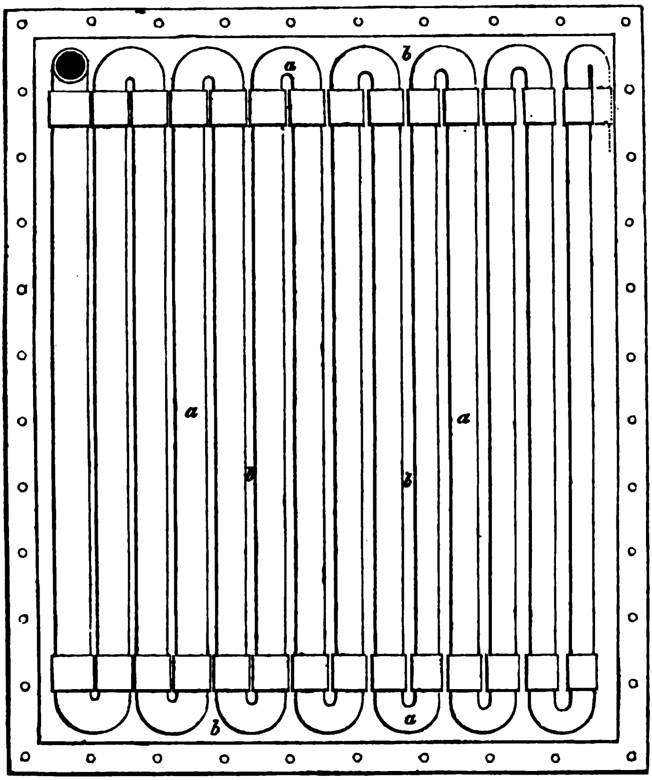


Fig. 2.



Sir,—In to-day's No. of your Journal, you state that one of the claims made by Mr. Bessemer in the specification of his last patent for improvements in the manufacture of glass is for "the heating of annealing ovens or kilns by the circulation through them of heated metals in pipes or chambers;" and also for "the application of the said method of heating by means of fluid metal to the annealing of glass tubes." As it might be inferred from this, that Mr. Bessemer has been the first, to substitute hot fluid metal for hot water, for heating purposes,

I beg to state, that as far back as the 20th of December, 1838, Mr. Andrew Smith patented an apparatus for heating fluids and generating steam, which was precisely on the same principle. I forward herewith, for your satisfaction, a copy of Mr. Smith's specification, and am, Sir, your obedient servant,

SUUM CUIQUE.

Strand, August, 1849.

[The application of metallic baths to heating purposes is much older than either of the patents referred to. Mr. Smith does not claim the invention of it any more than Mr. Bessemer, but, on the contrary, expressly disclaims it in his specification as a thing "*that has been done before.*" Each claims a particular application of it—that is all, and each has, we dare say, a very good title to what he claims. The thing is so good that we rather wonder it has not long before now come into general use. Mr. Smith's plan was a very feasible one, and merited more attention than it has (we fear) received. Having this impression of it, we willingly devote a page to bring its merits once more under the notice of the public, and subjoin the specification which accompanied the preceding communication. ED. M. M.]

Mr. Andrew Smith's Fluid Metal Steam Generator.

"My invention of improvements in apparatus for heating fluids and generating steam, consists in a peculiar arrangement of tubes or pipes, to be used as a continuous water chamber. These tubes or pipes are surrounded on all sides by a bath of fused metal, which, by communicating heat to the water in the tubes, converts it into steam. Fig. 1 represents a section, and fig. 2 a plan view of my apparatus; *a a a*, *a a a*, are the pipes or tubes forming the water chamber, and surrounded by a metallic bath, *b b b*, *b b b*, coloured blue in the drawing. The pipes or tubes, *a a a*, are supported by rods or plates, *c c c*, which are merely placed between each row of tubes, and not attached to the sides of the apparatus. It may be as well here to observe that the tubes or pipes, *a a a*, are allowed to lie on the supporting-rods, *c c c*, perfectly free and unattached to any part of the apparatus, because, if they were fixed in an immovable position, the expansion and contraction to which they are subjected would be liable to destroy the joints; *d d d d*, are steam chambers placed above the water tubes, and are in communication with them, and supplied with steam by means of the short pipe, *e*, shown by dots in fig. 1 of the engraving. It will be seen, by reference to the engraving, that the water chambers gradually increase in size, beginning at the left hand end of the lower row of tubes; that being the place where the water is supplied, until they arrive at the same end of the upper row. I sometimes construct the apparatus with three rows of water tubes or pipes, and in that case I make the lower row, or that at which the water is supplied, all of the same diameter, and the next row above a size larger, and the row above that larger still, so that instead of each separate tube being of an increased diameter, I increase the size of the whole row. I wish it to be understood that I do not confine myself to any precise number of tubes, or rows of tubes, to be used as water chambers, as it is evident that number may be varied according to circumstances. And I do not claim the heating of fluids, or converting water into steam by means of a metallic bath, as that has been done before; but what I claim as my invention is the peculiar arrangement of tubes or pipes as a continuous water chamber, herein set forth and described, such pipes or tubes increasing in diameter separately, or in rows, or series, as they approach the steam chambers."

The great advantages of this steam generator are based on the chemical principle that a bath of fusible metal absorbs heat 32 times quicker than water, the consequence being that the tube, of whatever length, being immersed in molten metals at a temperature of 500° Fah., is kept continually filled with high-pressure steam, constantly available for giving out its power; and the small quantity of water requisite for keeping up the supply is furnished without drawing to scarcely any perceptible extent on the powers of the engine. The saving of expense in fuel is very considerable; but its greatest advantage is in its adaptation for marine purposes, where it would take up only one-twentieth of the space of the present boiler, with a corresponding diminution in the weight, consequently leaving much room for additional goods, stowage, and freight, and in ships of war, below the water line, and out of the reach of shot.

NOTES ON HEATING AND VENTILATING.—COMPILED FROM THE UNPUBLISHED MSS. OF THE LATE BRIG.-GEN. SIR SAMUEL BENTHAM.

In Sir Samuel Bentham's Description of his Design for the Dockyard at Sheerness, he specified as one of the objects he had in view, "a more uniform atten-

tion to the arrangement of fireplaces, fire-flues, and chimneys," and "the introduction of air by doors and windows in a manner the least annoying to the persons within." Details of the improvements he projected under these heads have not been found; but as he had, for a long series of years, investigated the different modes of heating and ventilating buildings of all descriptions, the following compilation from his notes and observations on the subject, may not be without its use.

In regard to warming and ventilating large buildings, very good contrivances have already been introduced. The apparatus lately erected in the Middlesex Hospital, for instance, is said to be remarkable both for its efficiency and its economy. The present suggestions are, therefore, confined more particularly to private habitations,—a description of buildings respecting which the many attempts that have been made, to economise heat and to ensure good ventilation, seem to have proved failures in some respect or other. This want of success in a matter which so materially affects our health, our daily comforts, and our purses, seems to have arisen from a want of attention to our habits as much as from neglect of sometimes one, sometimes another of the desiderata. Air unpolluted from the exterior, still more the blaze of a cheerful fire, are enjoyments which in this country are ill dispensed with; chief objects, then, are those of admitting fresh air so as not to injure health from sudden draughts, and of giving heat from an open fire, yet so as to consume little fuel, and with as little waste of heat as possible.

Exposure to currents of air is perhaps the most frequent cause of common colds, as well as of the more serious diseases of the respiratory organs. Some seventy or more years ago, the late Dr. George Fordyce remarked, that amongst persons who attended at his house for gratuitous advice, there were at times nearly the whole of the many men employed at Brodie's manufactory of fire-grates,—these persons being usually affected with coughs and symptoms of inflammation of the chest. His curiosity was excited; he visited the manufactory, and found that air was admitted to it by louvre boarding, but so arranged that the cold air, on entering, was thrown down immediately on the men. The direction of the boards was at his suggestion reversed, so as to throw the cold air on entering upwards; consequently, by mixing with the hot air of the factory, the supply was warmed before it descended on the men, and, happily, their extraordinary liability to disease was arrested by this salutary, though slight alteration. In St. Thomas's Hospital he, on the same principle, caused a strip of board to be so fixed along the upper part of the window sashes, as that when they were a little drawn down, the air should in like manner be directed to the ceiling, and warmed before its descent on the patients; this, though so simple and partial a contrivance, was attended with marked benefit to the sick. In the manufactory of the Messrs. Strutt, at Belper, besides their most efficient apparatus for warming the factory with heated air, their windows were arranged so as to admit, when desirable in winter, a limited quantity of cold air at pleasure, without injury to the operatives. One pane of glass in the upper part of each window was inserted, not perpendicularly, but inclined inwards at an angle of nearly 60 degrees; it was framed and lined, the sides of it were closed in with glass, a slide was fitted to the top in such manner as that the opening might at pleasure be more or less closed; thus the cold air was thrown, as in the former instances, to the ceiling, instead of allowing a draught to rush upon the people.

On speaking of the factories of these gentlemen—models of order and comfort as regarded the operatives—it may not be irrelevant to mention a very important particular influencing the health of the people employed in factories. The Messrs. Strutt had ascertained that the most advantageous degree of heat for work-rooms is 60 degrees of Fahrenheit. At lower degrees it had been found that the fingers of the people became too much benumbed for work to be done either well or expeditiously, whilst at higher degrees it was evident that the operatives were enfeebled, became pale and emaciated,—not that a degree or two more or less made any material difference, but the degree fixed on to be kept to as nearly as possible was 60 degrees Fahrenheit. This coincidence with the degree considered at St. Petersburgh as the most healthful for apartments in pri-

vate houses, is remarkable; 12 degrees of Reaumur is there esteemed the most conducive to health, and 12 degrees of Reaumur is about equal to 59 degrees of Fahrenheit. Many rooms, it is true, are usually kept up to 14 degrees Reaumur, nearly 64 degrees of Fahrenheit, and some of the peasants' houses still higher at St. Petersburgh, but with bad effect on health, even where the amusements and employments are sedentary. On visiting afterwards the great fabric of Mr. Lee, at Manchester, where much had been done in the way of improvement, Sir Samuel found that the degree of heat maintained in the work-rooms there was 70 degrees Fahrenheit, and that there the baleful effects of this high temperature was apparent in the countenances of the operatives; but this great heat was thought advantageous in facilitating several of the operations in spinning the cotton, and the well-being of the people employed, was seldom at that time so studiously cared for as it habitually was by the Messrs. Strutt.

Considering the usual structure of our houses, some modification of the above-mentioned means of throwing cold air on its entrance up to the ceiling, seems easy of introduction. Inside shutters would, in many houses, preclude the use of projecting panes of glass, as at Messrs. Strutt's; but there are few cases where a strip of wood, in the manner of that at St. Thomas's, might not be introduced. It might be made more or less ornamental, might be so contrived as to direct the cold air against the ceiling behind the cornice of the window-curtain, thus providing for ventilation in evenings after the curtains are drawn, as well as by day; but whatever the modification of the apparatus, besides being simple, it should be so contrived as that the quantity of air admitted should be easily regulated, and it should not be in the way of throwing open windows in the usual manner.

The introduction of air in the proposed way seems particularly desirable in those cases, unfortunately so common, where a door or a window must be a little opened to prevent smoke; it is generally applicable for supplying the air requisite for combustion of fuel in common fires, instead of allowing that air to enter, as usual, through vacuities in the fitting of doors and windows. Air direct from without would be more healthful and agreeable than that which had first travelled up the staircase, perhaps from the kitchen and offices, bringing with it the odours usual in those localities.

Admission of fresh air being thus provided for, that which is vitiated must have the means of exit furnished for it. This could hardly be otherwise so easily effected as by the usual chimney, up which, if tolerably well constructed, the heated air of a room constantly ascends, though there be no fire. It may be said that a down draught, so frequently occurring, and so annoying, militates against this mode, but that inconvenience arises from insufficient admission of air to some other part of the house, so that sometimes air comes down a drawing-room chimney to feed the kitchen fire. The remedy is easy, partly by insuring a due supply of air to every part of a house where needed, and partly by a good construction of the tops of chimney shafts.

Some old engravings of houses at Venice show the chimney-pots of a different form from those in use here; the Venetian ones are enlarged funnel-wise at the aperture. Ventura's and Vince's experiments proved that the flow of liquids was the most considerable where the aperture of the pipe was enlarged funnel-wise, and the exit of all elastic fluids would probably, in like manner, be facilitated by a similar form of opening of the tube. In the low situation of Venice, experience may have led to a practice, the *rationale* of which remained for the science of after times to discover.

The next point of consideration is that of warming apartments by means of air more or less heated beyond the temperature of the atmosphere. Very many contrivances have been introduced for this purpose, most of them too complicated, too costly, or requiring too much attendance to render them available for moderatley-sized or small dwellings. In some cases, as in the Franklin stove, it has been only attempted to economise heat, by using that which would otherwise be lost to the warm air of the room; this he effected by fixing the fire-grate in a case of metal, placing that case in the usual fire-place, so that the air of the apartment might pass round it, being

prevented by the setting of the stove from going up the chimney. The so-called Prussian stove is on the same principle. Both of them economise heat at the same time that they afford the pleasures of an open fire; but still cold air must enter the room to supply the fire, although not in sufficient quantity for healthy respiration where many persons are assembled. The distinguished chemist, Cavendish, towards the end of last century, contrived a stove, which in practice has been found to produce perfect ventilation, with a most agreeable temperature of the apartment, and with but a small expenditure of fuel for a brilliant open fire. His fire-grate, with polished bars, was set in fire tiles, which formed a casing like that of metal usual in register stoves, and in like manner it was constructed in the usual fire-place; but the outer dimensions were such as to leave a vacuity at the sides of, and behind the case; the vacuity was closed in at top with tiles, and in front ornamentally with metal or marble. The opening above the fire-grate was the whole length of it; this aperture, closeable more or less at pleasure, by a plate of metal, 8 or 10 inches broad, inclined forward, and worked tight at the ends of it. The vacuity around the case was an air chamber, having its supply pipe laid under the floor to the outside of the house, and a delivering pipe opening into the apartment from the upper part of the air chamber. This arrangement has perhaps never been even equalled for simplicity, neatness, economy of fuel, due ventilation, and the attainment at will, of any desired temperature with the pleasure of an open fire.

Very many fire-places have from time to time been arranged on this principle, yet it has never become of general practice, and this most probably on account of a source of occasional failure which has not been adverted to; namely, that its *uniform* success depends on the points of the compass from which the wind may come. Suppose, for example, the supply pipe to enter from the west side of a house, then with all winds from about south by west to about north, the disposition of the air would be to enter the supply pipe from *without*, so as to be delivered within the apartment; but with winds from the south by east to the north, air would be disposed to enter at any openings northward, and to drive the air from the heated chamber out of doors to the westward. This inconvenience has not been found to take place with moderate winds, but in violent ones it has amounted to a total reversal of the effect of the ventilating apparatus. But this derangement seems capable of being provided against.

The excellence of Mr. Cavendish's fire-place had been noticed by the great French chemist, Monsieur Berard; he copied it first in his own house at Montpellier, then in the houses of several friends, and always with success; but this depended, it would seem, on a particular which indicates a modification of the apparatus, which should be observed in English houses. French houses, usually so much larger than ours, have, generally speaking, long corridors, open at both ends, on their basement floors. Monsieur Berard, instead of taking his supply of air from without, obtained it internally from one of those corridors, so that from whatever quarter the wind might blow, the supply to the air-chamber was uniformly the same; there was, however, one attendant inconvenience—the air was liable to be less pure than that of the external atmosphere.

Experience, therefore, has proved that on this principle the advantages are obtainable of perfect ventilation, by air of an agreeable temperature, combined with the pleasantness of an open fire, and the smallest loss of heat compatible with that comfort: it is a cleanly arrangement, either neat and cheap, or more or less ornamented. What remains to be contrived is, the mode of regulating the entrance of the air according to the wind. Suppose, for instance, that in the basement story of a house, a small air chamber or pipe were provided, communicating with the open air by two separate pipes, these pipes having their apertures respectively on opposite sides of the house; by such an arrangement alone, air would enter from the side on which the wind might happen to blow; other pipes, leading from this general chamber, might be carried to as many of the apartments as desirable, and the rarefication of the air, by the heat of the fire, would ensure a constant current upwards. Where thought worth while, the arrangement might be rendered perfect by means of an internal

valve in the general-receiving chamber, so as to close one end of it or the other, according to the wind: these valves might be self-acting, by means of a rod of metal connecting them with a vane on the top of the house.

There is, however, one point which seems to call for investigation as to this mode of ventilation, in common with all other modes where the air is heated. In certain states of the atmosphere, it is well known that on being heated, the capacity of air for absorbing water is greatly increased, so much so as to become injurious to health, by taking up moisture from the skin; this mischief has been particularly noticed in the use of Arnott's stoves, and has been remedied by keeping a dish of water constantly on the stove; and might be easily provided against in Cavendish's mode, by placing, where needful, a vessel of water in the air-chamber. "Where needful" is said, because in this climate, times of frost excepted, it rarely happens but that the external air requires, for healthfulness, to be dried.

In the construction of new houses there seems much room for improvement of the fire-flues, especially in habitations for persons of a description who would consider economy of fuel a recommendation. Even where, as in the above-described air-chambers, much of the heat from open fires is utilised, still there is considerable waste of it up the chimney. To obviate this loss, the outline of an arrangement was devised for at least second and third-rate houses, in Sir Samuel's projected new town at Sheerness. It was, instead of brick chimneys in the usual way, the substitution, for each shaft, of a metal pipe inserted in another of earthenware; these pipes to pass side by side successively, from room to room above, not enclosed by any permanent wall or other concealment; but skreens were to be provided ready to shut off the heat they would communicate, whenever that might be wished. In the drawing-room of the Governor of Carlscrona, the stove was a column, with its appropriate base and capital, of the usual white glazed ware with which stoves are faced in Sweden and Russia; it was highly ornamental, and considering the superiority of our pottery chimneys of this material, might be beautiful.

Few houses are exempt from the evil of smoky chimneys; yet though there be contrivances of cowls, and differently-shaped pipes to remedy it, (several of them effectual for a single shaft,) it rarely happens that there is room to place more than one of these additions, on account of their projections. In some manufactories the shafts from several fires have been united in one at the top, and have been then surmounted by a cowl. Has this expedient ever been tried for private dwelling-houses? If so, with what success? And how was the down draught from one chimney to another prevented?

The manner in which many of the buildings of Sheerness were to be constructed, afforded opportunity of introducing, as Sir Samuel specified, "cool air in some cases from places underground," in the manner of the *ventaroli*, frequent in some parts of Italy; but in this climate a luxury of the kind seems hardly worth consideration for private houses, however advantageous it might be in several manufactories where the workmen are exposed to excessive heat.

LAW OF PATENTS.—REPORT OF THE COMMITTEE ON THE SIGNET AND PRIVY SEAL OFFICES.

Extracts from Minutes of Evidence.

(Continued from page 116.)

Mr. J. C. Robertson examined.—Do you think there ought to be a difference between the fees for English, Scotch, and Irish patents?—I cannot understand why there should be any.

At present the fees for Irish patents are higher than those for English, and the fees for Scotch patents are lower?—That is so.

Do you think it desirable to retain the system of taking out separate patents in the three kingdoms?—I do not; I am sure it is exceedingly inconvenient. At all events, if the three patents are to be still continued, I think that a party simply filing a memorandum, stating his desire to add Scotland or Ireland, and lodging some fixed sum of money, should be entitled to have the addition at once made.

When a patent has been obtained for England, is there much delay in extending it to Scotland or to Ireland?—In Scotland the proceedings are very rapid. In Ireland the delays are often very great.

Do hearings ever take place before the Crown lawyers in Scotland or in Ireland?—In Scotland, not very often; in Ireland, scarcely ever.

Do you think it desirable to retain that check upon a patent?—I think not, providing a party has had an English patent previously upon the report of the English Attorney-General. I do not think there should be any further hearing, and that it should follow as a matter of course, that if the party chooses he may also have a Scotch or Irish patent, or both.

Are there many inventors in Scotland, or in Ireland, or are most of them in England?—The majority are in England.

Supposing a person makes an invention in Scotland, probably his first thought would be to obtain an English patent?—Yes: and it is generally the most important of all the three.

The English is the more valuable patent of the three?—Yes; there is no comparison.

In the case of a Scotch inventor, it would be no hardship to him to require him to make his application in London, before he made it in Edinburgh?—No hardship; it would be merely the expense of postage, which is nothing now to speak of.

Do they more frequently make applications in Edinburgh or in London first?—In Edinburgh not frequently—occasionally they are made; I think never in Ireland.

They all come to London?—Yes.

Are there ever any Irish inventors?—A few, not many.

You say a few take out their first patent in Scotland?—Yes.

What proceedings then take place?—A petition to the Crown, a reference to the Lord Advocate, a report from the Lord Advocate, and then a warrant from the Crown for affixing *per saltum*, as it is expressed, the Great Seal.

Are the proceedings before the Lord Advocate more carefully conducted than if the patent having been first taken out in London is extended to Edinburgh?—The proceedings so far are nearly identical in Scotland with those in England, with this difference, that instead of allowing eight days they allow ten days in cases of opposition upon a caveat.

I think you stated that a patent having first been obtained for England, the proceeding then before the Lord Advocate is almost a mere form?—It is so, generally speaking, except there is opposition. Oppositions are sometimes entered in Scotland, after the English patent has been taken out. Parties take the chance of a second hearing before a different officer of the Crown, in the expectation that though they have failed in the one country they may succeed in the other.

Assuming the present amount of fees in England upon a patent to be about 100*l.*, is that an excessive charge?—I think it is, considering that it takes upwards of 200*l.* more to include Scotland and Ireland. The policy of imposing a fine (as it were) upon inventors seems in an abstract point of view altogether objectionable, but the question is by no means free from difficulty. If patents were cheapened, and no other obstacle put in the way, I think there would be a great deal of public inconvenience felt from an excessive multiplication of useless patents. Having been editor of the *Mechanics' Magazine* for many years, I have been constantly applied to by ingenious men about inventions and discoveries they supposed they had effected, and I am satisfied that if there were no obstacle in the way of expense the number of worthless patents which would be taken out would be enormous.

Do you think an enormous multiplicity of patents would be an advantage?—Decidedly not.

Do you think that the owners of such patents would in the end be gainers by their monopoly?—Very few indeed; but the manufacturers get trammelled and embarrassed by the pretensions of people of that description. It is common with all manufacturers to have claims made against them by parties thinking that they are using their inventions, and a manufacturer rather than go to law with them will compromise the matter, and pay something by way of hush-money. I think it would be found a hinderance to trade and manufactures.

Would not a multiplicity of patents lead to litigation?—Certainly it would, in proportion to the number of patents. It seems to me that if patents were excessively cheapened, it would be then requisite to subject all applications for patents to a much stricter scrutiny than is now the case; and then possibly the Attorney-General might require to have some person in the way of an assessor to enable him to go through them, not allowing every one to pass, simply because it happens to be unopposed.

Assuming that it is not desirable to make them extremely cheap, and that some obstacle ought to be offered to the grant of a monopoly upon grounds of public policy, do you consider the present amount of fees too large?—A great deal to large in any point of view.

What would you say should be the proper sum?—I think parties would not object to something between 25*l.* and 40*l.* I gather that from inventors themselves, and there are very few that could not muster that.

Would you require an additional fee for the extension of a patent to Scotland or Ireland?—I think so.

What amount of fees would you suggest?—I should think they might be put on a par, say half the price of the English patent. The Scotch patent is the more valuable of the two. But it would hardly be worth while to make any distinction between the Scotch and the Irish.

You would grant an English patent, setting aside the charges of agency, for 40*l.*, and you would extend that patent to either Ireland or Scotland for a fee of 20*l.* for each kingdom?—Yes.

Therefore the patent would be obtained for the three kingdoms for 80*l.*?—Yes.

Exclusive of the cost of agency?—Yes.

Have you any suggestion to make with regard to the present mode of preparing the specification?—None; I think it is proper to allow six months to complete the outline specification; supposing the outline specification lodged at the time of the report in every case, I see no objection to that.

Do you think there is sufficient check now upon the preparation of the specification?—I think that parties must be left to prepare them as they think proper, and that there should be no public interference in that respect. I should recommend one Enrolment Office. There is great inconvenience in having patents enrolled in three different offices.

Is there any other suggestion you have to make?—There is this; if the present system of going through a number of offices is to be continued, the inequality of the fees charged at each office should at all events be rectified. Take, for example, the fees charged for an additional name—it can evidently make no difference worth speaking of in point of trouble, whether there is one or two names in a patent, while it is very certain that the addition of a second name does not double the value of the property; yet for that additional name the following extra fees are exacted at the different offices.

[*Hands in the following statement.*]

Extra Fees.

	Home Office.	Patent Bill Office.	Signet Office.	Privy Seal Office.	Great Seal Office.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
For an additional Name......	1 7 6	1 7 6	5 18 6 (One Name £4 7s.)	5 18 6 (One Name £4 7s.)	2 18 4
For the addition of the Colonies	1 7 6	0 2 6	0 18 6	0 18 6	......

That means, not when a name is subsequently added, but for a second name in the original patent?—Yes, but no principle seems to regulate the addition; there is no rule by which they are guided at all.

In the case of a renewal of the patent, the hearing takes place before the Judicial Committee of the Privy Council?—Yes, it does.

Have you any suggestion to make with regard to the proceedings there?—None; they are considered highly satisfactory, and give very general satisfaction; they are comparatively cheap, too.

(*To be continued in our next.*)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 9TH OF AUGUST.

Jean Adolphe Carteron, now of Paris, France, but late of the Haymarket, Middlesex, chemist. *For certain improvements in dyeing.* Patent dated February 5, 1849.

The nature of this invention is stated to consist in the composition and preparation of certain mordants to be used in dyeing, in lieu of the cream of tartar and cream of tartar and alum, now commonly used, whereby colours of superior brilliancy and variety will be produced at less cost than heretofore.

The said mordants are four in number, and compounded and prepared as follows:

First Mordant.

I dissolve eighteen parts of common salt and nine parts of tartaric acid in sixty-seven parts of boiling water, and add to this solution eighteen parts of the acetic acid of commerce.

About one pound weight of this mordant is equivalent for dyeing purposes to about one pound of cream of tartar, and it is employed in precisely the same manner.

It is suitable for crimson and all reddish dyes.

Second Mordant.

I take two parts of the residuum of the manufacture of nitric acid (namely, sulphate

of soda), made with nitrate of soda and one part of alum, and triturate and mix the whole well together.

About two pounds and a quarter of this mordant is equivalent to half that quantity of cream of tartar, and employed in the same way.

It is suitable for all olive and brown dyes.

Third Mordant.

I take one part of the residuum of the manufacture of sulphuric acid, made with nitrate of potass, and five parts of common salt: triturate and mix as before.

It is to be used in the same proportions with cream of tartar as the second mordant, and is applicable to black and dark colours only.

Fourth Mordant.

I dissolve six parts of sulphate of alumina, three parts of nitric acid, and one part of caustic lye, of 24° Beaumé, in twenty quarts of boiling water.

This mordant may be used in dyers' baths for green dyes of all shades, and fancy dyes, and in the proportion of one pint for every twenty pounds weight of woven fabrics.

Claim.—I declare that the improvements in dyeing which I claim as constituting my said invention, are the four mordants aforesaid, each in the peculiar combination of materials of which it is composed, and mode of compounding the same.

Edmund George Pinchbeck, of Fleet-street, London. *For improvements in certain parts of steam engines.* Patent dated February 6, 1849.

The object of this invention is, to accomplish the working of an air-pump or pumps, without having recourse to a separate crank or cranked shaft, introduced for that purpose, as is generally the case, in direct acting and oscillating steam engines, and may be described in reference to one engine as follows:

The reciprocating motion required by the air-pump is to be communicated by a connecting rod and beam, or by a simple connecting rod, from a revolving point situated between the centre of the crank-pin and the centre of the main shaft, and on a plane parallel to the face of the crank nearest the crank-pin, and between the same and the collar of the bearing on the main or paddle-shaft immediately behind. The requisite rotary motion is thus obtained, without having recourse to any independent crank, cam, excentric, or modification of the crank-pin, and without fixing any additional piece whatever on the main shaft or shafts for that purpose; being effected by taking advantage of the existing crank of the engine, and slightly altering it in form merely, without in the slightest degree interfering with the ordinary function of the crank.

In the case of direct acting or oscillating engines of a larger size, (and to this class these improvements more particularly refer,) it is considered that the getting in of the centre cranked shaft is a desirable object to effect, as the difficulty and expense of forging and fitting up so large a piece is very great, not to mention the further objection, arising from its liability to unsoundness; besides which, the bringing of the two cylinders nearer to each other will be attended with a saving of space in the vessel, and a greater compactness in the construction of the engines.

Claims.—First. The making of cranks with an intermediate pin, as shown and described.

Second. The various applications of the same, as exemplified and described.

Joseph Harrison, of Blackburn, machine-maker; William Harrison, of the same place, cotton manufacturer; and John Oddie, of the same place, manager. *For certain improvements in and applicable to looms for weaving.* Patent dated February 6, 1849.

Claims. — First. Certain described arrangements for detaching and connecting the break to the fly-wheel of power looms.

Second. Other described arrangements by which a loose reed loom is made equal to weaving goods of any strength, the reed being fixed while pressing up, and swung loose upon the stay when the shuttle misses boxing.

Third. Some arrangements shown and described, by which the pattern is varied, by means of bowls and treadles, which are acted upon by a set of revolving bowls, actuated by the second motion.

John Taylor, of Parliament-street, Westminster, architect. *For an improved mode of constructing and facing walls.* Patent dated February 8, 1849.

This improved mode of facing walls consists of making the facing bricks, plates, or blocks (which are represented as being thinner than a brick, and of sufficient size to cover the depth of three courses) with a projecting piece on the back and flush with its upper edge. This projection is of the same thickness as a brick. When the facing is put upon the wall, the projection is put into a rebate, formed by keeping back one of the courses of brick; by this arrangement the facing plates do not bear on each other, but are supported by the wall.

Claims.—The arrangements described for facing walls, so that the blocks forming the facing may not be made to support each other.

James Webster, of Basford, Nottingham, engineer. *For certain improvements in apparatus for manufacturing gas.* Patent dated February 8, 1849.

The improved apparatus consists, first, of a hollow vessel which is heated in a furnace, into which naphtha is slowly allowed to flow; the gas generated from the naphtha passes up through a bed of coke; it is then brought into contact with a surface of melted rosin, which is allowed to fall upon heated bars of metal; the gas is from thence conveyed through another layer of coke or iron, and by bent pipes passes through condensing vessels, by which the naphtha brought over along with the gas is separated from it; the gas is then fit for use, and the collected naphtha may be used for making the gas.

No claims.

Richard Pannell Furlong, of Bristol, button manufacturer. *For improvements in castors for furniture.* Patent dated February 8, 1849.

The improvements in castors consists in making the roller of glass, and the other parts of nickel or silver. Castors of this description are well adapted for insulating, and bring out the tone of musical instruments. The glass rollers have either a hollow bush or a spindle inserted into them while in a soft state; they are afterwards ground by an apparatus, in which the glass roller slowly rotates in one direction, while the grinding-stone revolves in the opposite direction.

Claim.—Making the rollers of castors of glass.

William Willcocks Sleigh, of Stamford Brook House, Chiswick, Middlesex, doctor of medicine. *For a means for preventing injuries to persons and property from the sudden stoppage of railway carriages.* Patent dated February 8, 1849.

The "means" specified consist of the application of a rule or toggle-joint to force the break up against the wheels. The toggle-joint is placed between the two wheels of the carriage, and when acted upon by a lever placed near to the guard, it causes the breaks to rub against the wheels. Another arrangement, nearly similar, is shown, by which the toggle-joint is made to act upon pieces taking hold of the rail.

Claim.—The application of the arrangements for acting either upon the wheels or upon the rails, for the purpose of stopping railway trains.

Robert Brown, of Sadlers Wells, Middlesex, engineer. *For improvements in machinery for perforating, sewing, stitching, pegging, and riveting.* Patent dated February 8, 1849.

The machinery described by the patentee is of a very complicated nature, the movements of which are effected by gearing, lever, cams, &c. A description would be impossible without the aid of engravings.

Claim.—The combination of mechanical arrangements for perforating, sewing, pegging, and riveting.

William Tooth, of Broad-street, Lambeth, engineer. *For improvements in water-closets, and in chimney-pieces, in machinery for the preparation of clays and other materials, and in the manufacture of earthenware articles.* Patent dated February 8, 1849.

The first improvement consists in the formation of the valves of water-closets of earthenware and glass. The surfaces of the valves are so arranged that they shall rub upon their seats, and clear themselves from dirt. And the pan is connected with the soil-pipe by an intermediate pipe, in which is placed the valve.

The second improvement is in the forming or moulding the jambs and lintels of chimney-pieces, which are made of glass or earthenware in one piece; that is, each jamb and each lintel consists of one piece; these as now made are composed of several pieces cemented together.

The third improvement is in the apparatus employed for cleaning and preparing clay to be used for earthenware, and consists of a cylinder, into which there is fitted a piston: the body of the piston is hollow, and covered with wire gauze; the semi-fluid clay is poured into the cylinder above the piston; the piston is then drawn up by some mechanical arrangement; the atmospheric pressure causes the finer clay to permeate through the wire gauze of the piston; it is afterwards drawn off from the bottom of the cylinder.

The fourth improvement consists of making the dod or die-plates for making or moulding pipes of earthenware, without a bridge to support the central part, or core. The die-plate in one case is supported by a rod passing right up through the cylinder and compressing piston.

Claims.—First. The formation of the valves and connecting-pipe of water-closets, as exemplified.

Second. The moulding of the jambs and lintels of chimney-pieces, made in earthenware or glass, in one piece.

Third. The apparatus for preparing clay.

Fourth. The formation of dod-plates, as described, without a cross bridge.

Thomas Charles Clarkson, of Bennett-street, Southwark, manufacturer. *For improvements in the manufacture and application of leather, and of certain vegetable*

substances to be used in combination with leather, India-rubber, canvas, silk, cotton, wool, and other fibrous substances. Patent dated February 8, 1849.

The first improvement consists in preparing the skins by a solution of chloride of sodium and alumina, in which prepared state they will answer many purposes for which leather is employed, better than even leather. The skins so prepared have a slight surface of leather given to them by being immersed in a solution of tannin. The skins so prepared, when for leather, are suspended in the tan-pits with a space between them, to allow of the circulation of the tan liquor, which is made to flow fresh, or in a strong state, into the tanks at top, while the expended liquor is slowly allowed to flow out at bottom.

The second improvement is in making bands or driving belts of leather, by putting plies of the stronger parts of the hides over those of the weaker parts, and introducing layers of cork, and cementing with a solution of India-rubber.

The third improvement is in combining thin shavings or plates of cork with fabrics of silk, cotton, wool, &c. The cementing of these is effected by a solution of India-rubber; the finished fabric to be used for articles of dress, &c.

The last improvement consists in forming hat bodies by a process nearly similar to the third improvement.

Claims.—1. The arrangement described for tanning leather, and for the preparation of the skins.

2. The manufacture of bands of leather by combining the weaker with the stronger parts of the hide, and the interposed layer of cork and India-rubber, with the formation of such bands upon a drum.

3. The fabric described under the third head for manufacture of various articles specified.

4. The combination of tarlatan or other fabrics with cork and a solution of India-rubber, for the formation of hat bodies.

THOMAS SNOWDEN, of Noel-street, Middlesex, engineer. *For improvements in machinery for moulding and pressing artificial fuel and bricks.* Patent dated August 6, 1849.

These improvements consist of the application of a machine with levers, acted upon by a pin placed in a revolving wheel or dice, and being in this respect nearly similar to the motion of the old boiler-plate punching machine. Instead of the punches being attached to the levers, there are plungers which compress the materials of artificial fuel or bricks into proper moulds for the purpose. The feeding-in of the unformed materials and the emptying of the moulds are effected by the action of cams or eccentrics upon levers fitted on the machine.

Claim. The combined machinery described for moulding blocks of artificial fuel and bricks.

JOHN BROWNE, late of Bond-street, but now of Great Portland-street, Middlesex, engineer. *For improvements in constructing and rigging vessels, and improvements in atmospheric and other railways.* Patent dated August 6, 1849.

The improvement in "constructing and rigging vessels," consists of mounting the sails of vessels upon frames, and connecting these frames to a wheel, by which the whole set of sails upon a vessel, supposing her to have six masts, would be moved at the same instant.

The improvement in "atmospheric railways" consists in the construction of an atmospheric valve, the peculiar feature of which is, that it is kept down to its seat by means of springs.

The improvement in "other railways" consists—

1. In laying down a few planks upon the ground, to which there is to be attached a rail of very slight construction. And

2. In effecting the transit by means of balloons, which are to convey the goods and passengers. The balloon is to be attached by the car to a locomotive placed upon the rail.

No claims.

LAWRENCE HILL, Jun., of Motherwell Iron-works, near Hamilton, civil engineer. *For improvements in the manufacture of iron, and in the machinery for producing the same.* Patent dated August 8, 1849.

Mr. Hill's improved machinery consists of three cones, which are mounted upon spindles, and made to revolve by means of wheel gearing. These three cones are placed in a horizontal circle, and have their axis inclined to each other, so that if continued, they would meet in a point; the apices of the cones point downward, and thus the three cones form a sort of hopper, into which the bloom or ball of heated iron is placed. The rotation of the cones by means of the gearing, causes the bloom or ball of iron to be drawn out, in which case it is formed into a rod, the diameter of which is defined by the distance between the apices of the cones.

Claim.—The arrangements described by which the iron is puddled and drawn out by means of rollers revolving at right angles to the direction of the formation of the rod.

HENRY HEADLY PARISH, of Eaton-place, Middlesex, Esq. *For improvements in safety and other lamps, and in*

gasburners. Patent dated August 8, 1849.

Mr. Parish's safety lamp has a cone of wire gauze round the burner, through which the air is admitted to the flame, having previously entered by a perforated cylinder. The flame is surrounded by a cylinder of glass for transmitting the light, and also provided with a glass chimney. The wire gauze is silvered by the electrotype process, which causes it to reflect the light, and imparts to it besides greater strength. The patentee claims the whole of the lamp as being new, except the reservoir for the oil. The gas-burner specified is of the argand form; in the central opening there are placed two wire gauze cones, one above and the other below the level of the point of escape for the gas. A better mixing of the air with the gas is stated to be thus effected, and the arrangement is claimed as being new.

Specification Due, but not Enrolled.

Joseph Barnes, of Church, Lancaster. *For an improved apparatus for bleaching, dyeing, cleaning, and steaming animal or vegetable fibrous substances, either in a raw or manufactured state.* Patent dated February 8, 1849.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Thomas, of Cheapside, merchant, and John Marsh, foreman to the said William Thomas, for improvements in the manufacture of looped fabrics, stays, and other parts of dress; also in apparatus for measuring. August 9; six months.

Arthur Howe Holdsworth, of the Beacon, Dartmouth, Esq., for improvements in the construction of marine boilers and funnels of steam boats and vessels. August 9; six months.

William Furness, of Lawton-street, Liverpool, builder, for improvements in machinery for cutting, tenoning, planing, moulding, dovetailing, boring, mortising, tonging, grooving, and sawing wood; also for sharpening and grinding tools or surfaces, and also in welding steel to cast iron. August 9; six months.

John Knowlys, of Heysham Tower, near Lancaster, Esq., for improvements in the application and combination of mineral and vegetable products, also in obtaining products from mineral and vegetable substances, and in the generation and application of heat. August 9; six months.

Alfred Vincent Newton, of Chancery-lane, for improvements in derricks for raising heavy bodies. (Being a communication.) August 9; six months.

LIST OF IRISH PATENTS FROM 20TH OF JUNE, TO THE 21ST OF JULY, 1849.

James Hamilton, of London, civil engineer, for improvements in cutting wood. Sealed, June 28; six months.

Michael Loam, of Treskerley, Gwennagh, Cornwall, engineer, for improvements in the manufacture of fuzees. June 30; six months.

David Smith, of New York, in the United States of America, lead manufacturer, for certain new improvements in the means of manufacturing certain articles in lead. July 7; six months.

William Newton, of 66, Chancery-lane, civil engineer, for improvements in the Jacquard machine. July 11; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Aug. 2	1978	Theresa Lawrence	Ludgate-hill	Ladies' belt, with elastic ligature attached adapted for other purposes.
,,	1979	Robert Frederick Miller	Hammersmith	Omnibus.
4	1980	M. and S. Butcher	Bristol	Self-acting laths of iron to metallic bedsteads, sofas, &c.
,,	1981	Sidney Smith	Willenhall	Lock.
6	1982	Samuel Denison	Leeds	Machine for stretching woven fabrics.
7	1983	John Roe	West Bromwich	Horseshoe.
8	1984	John Walker	48, Shoe-lane, London, builder	Effluvia trap for sewers and water-closets.
9	1985	Thomas James Tasker	Great Dover-street, Borough	Resilient shirt-collar fastener.
,,	1986	John Roberts	34, Eastcheap	Strawberry tile.
,,	1987	Thomas Waller	Hoxton	Fire-lump stove.

NOTICES TO CORRESPONDENTS.

The Supplement, containing Title and Table of Contents, is now ready to be had of the Publisher, Gratis.

CONTENTS OF THIS NUMBER.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1358.] SATURDAY, AUGUST 18, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

FISHER'S PATENT IMPROVEMENTS IN COKE OVENS.

Fig. 12. Fig. 13.

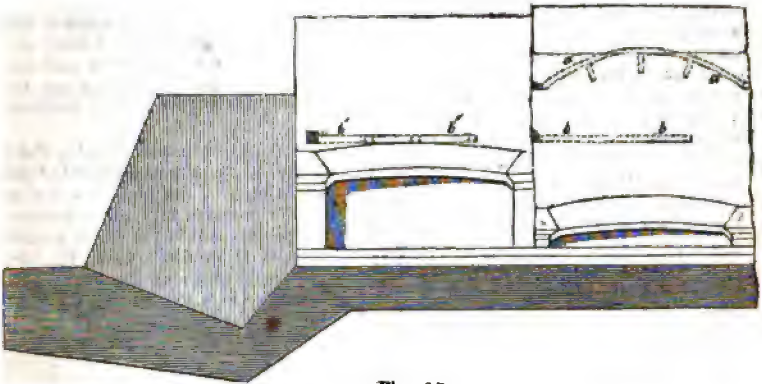


Fig. 17.

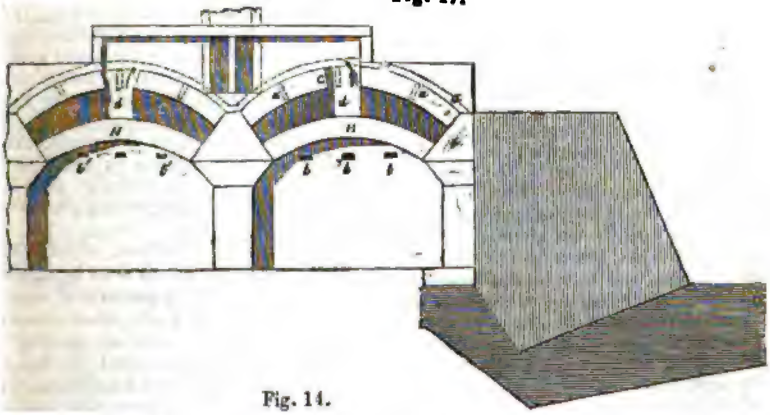
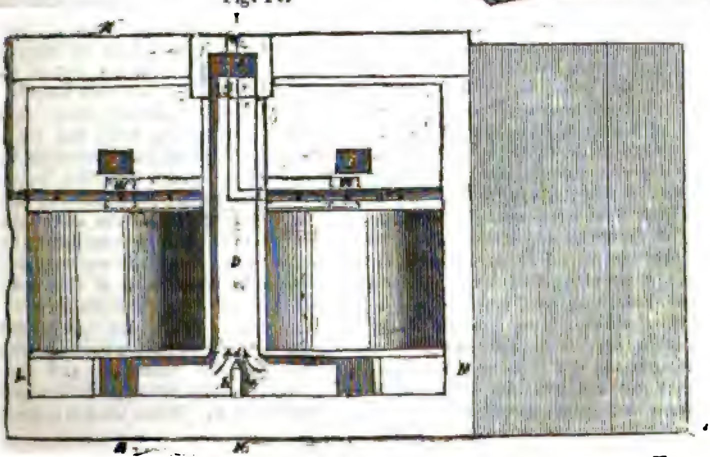


Fig. 14.



FISHER'S PATENT IMPROVEMENTS IN COKE OVENS.—(CONTINUED FROM. P. 124.)

Mr. Fisher describes, *secondly*, some improvements in the method of charging coke ovens, before referred to as having been patented by Mr. Cox:

Fig. 12 is a front elevation, and fig. 13 a back elevation of an oven embodying my said improvements. Fig. 14 is a plan of two of a series of such ovens; fig. 15 is a section on the line A B of fig. 14; fig. 16 is a longitudinal section of the pier which separates the pair of ovens in fig. 14 on the line I K. Figs. 15ᵃ and 16ᵃ are sections of an oven constructed according to Cox's patent, taken on the same lines as the sections of my improved oven given in figs. 15 and 16, in order to show more clearly the differences in construction between them. Fig. 17 is a section on the line L M of the plan fig. 14. Fig. 18 is a plan of the floor, with the door of the oven and the aperture at the back open; and fig. 19 is a horizontal plan of the oven above the door, where the front air flues, $b^1\,b^1$, and back air flues, *b b* (as in figs. 12, 13, 15, 16, 17,) enter the ovens.

N, figs. 15 and 15ᵃ, is the oven.

F, fig. 15, is the hole for charging the oven with coal or slack (see also figs. 4 and 7 of the engravings described under the first head of this specification).

G, figs. 15, 15ᵃ, and 17, is the top arch, and H the bottom arch. The bottom arch, H (see fig. 15), is not carried through to the back of the oven, but stops short at W, leaving an open space, R, the whole width of the oven, and immediately beneath the charging hole, F, which enables me to introduce the coal or slack direct to the oven from the top, and at the back thereof, without passing through more than one arch. By referring to fig. 15ᵃ, it will be seen that in Cox's oven, the bottom arch is carried quite through to the back, and that the same thing could only be effected by cutting a passage through both arches, as indicated by the dotted lines, V. The opening, R, fig. 16, serves also as a passage for the ascent of the gases from the interior of the oven into the flue, C, which runs along the top of the oven between the top and bottom arches, G and H; *a a*, figs. 13, 14, 16, 17, are the air flues over and through the top arch, as described under the first head of this specification. $b^1\,b^1$ are air holes in the front, and *b b* other air holes in the back of the oven, as in figs. 12, 13, 15, 16, 17, 19.

D is a discharge flue common to the pair of ovens in fig. 14, and into which the used gases from the ovens escape through the passages, *c c* and *h h*, and unite at *d*, as in the ovens first before described.

Fig. 15ᵃ is a passage of the whole width of the oven, for the escape of the gases from the interior into the flue, C, which leads to the chimney; *h* is an air hole, which leads from the front of the oven into the flue, C; and *i*, fig. 16ᵃ, is another flue, which conveys the air from the front to the back of the pier (separating a pair of ovens), and is continued at *k* across the back, with lateral openings into the interior of the oven.

Sometimes, instead of using the opening, R, fig. 15, for the passage of the gases from the interior of the oven into the over-flue, C, the patentee makes a separate opening for the purpose in the front, similar to that marked Q in Cox's oven, fig. 15ᵃ, and of the entire width of the oven; but in that case, he stops the flue at the part W, and carries up a wall from that part to the upper arch, G, as indicated in dotted lines in figs. 14 and 16.

Again; he sometimes shortens the top arch, G, instead of the lower arch, H; that is to say, he carries it no further than the point, W, and carries the lower arch quite to the back of the oven, but leaves an opening in it immediately under the charging opening, F.

But he prefers, on the whole, the plan first described, because by this plan he is enabled to carry the discharge flue, D, the whole length of the separating pier, as shown in figs. 14 and 16.

Mr. Fisher describes, *thirdly*, a distributing break which is to be applied to coke ovens, for the purpose of intercepting the coal or slack when thrown in from the top, through an opening such as that before mentioned (F, figs. 4, 7, 14, 15,) and spreading it more evenly over the interior of the oven than heretofore.

When the coal or slack is thrown in as usual without anything to break its fall, it descends heavily on one part of the bottom of the oven, and becomes heaped up there in a very compressed state; whereas, to effect the coking well, the coal or slack should be spread evenly over the entire floor of the oven, so that the heat may the more completely permeate the entire mass. The construction of the distributing break which I employ is represented in fig. 20, and also in fig. 7 of the engravings described under the first head of this specification. It consists of two iron plates, *b, b, b, b*, and *c, c, c, c*, of which skeleton representations are given in fig. 20, which are swivelled to one common shaft, A, and are free to diverge to any extent permitted by the chord chains, E E. When used it is dropped end-

Fig. 15.

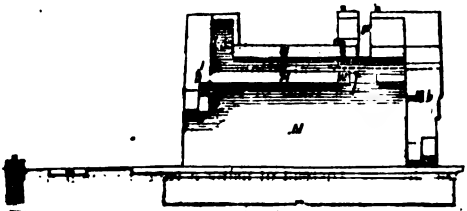


Fig. 15a.

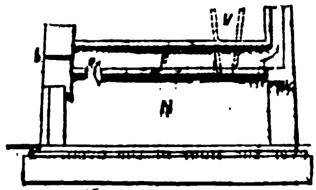


Fig. 24a.

Fig. 24.

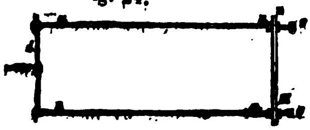


Fig. 16.

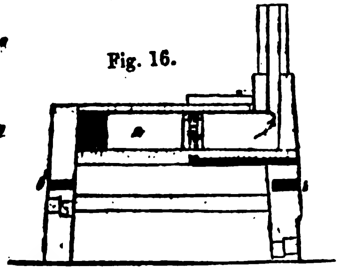


Fig. 25.

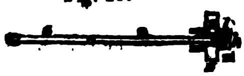


Fig. 20.

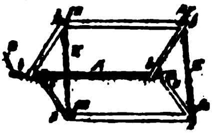


Fig. 18. Fig. 19.

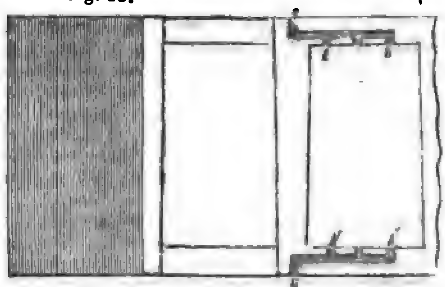


Fig. 26.

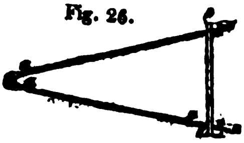


Fig. 23.

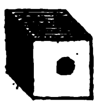


Fig. 28.

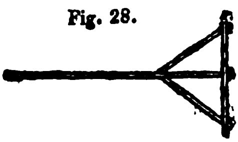
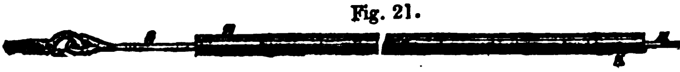


Fig. 22.

Fig. 21.



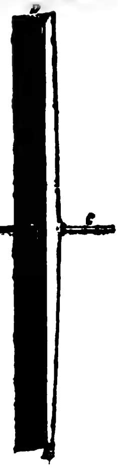


Fig. 16a.

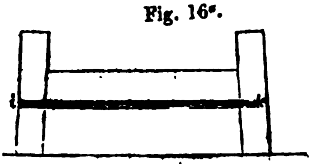
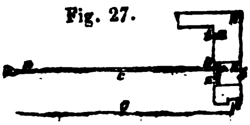


Fig. 27.



wise, and in a folded or collapsed state, down the hole, F (figs. 4, 7, 14, and 15), by means of the chain, B. It is then turned round on its face by the chains, D D, and made secure by these chains to the top of the outside of the oven, as shown in fig. 7, on which the plates expand and assume the roof-like position represented in fig. 20, and serve not only to break the force of the fall of the coal or slack, but to distribute it over the floor of the oven. To raise the apparatus out of the way, it is only necessary to ease the chains, D D, and pull up by the chain, B, when the plates will collapse as before, and return through the hole.

Mr. Fisher describes, *fourthly*, certain other machinery or apparatus to be used in connection with coke ovens, for the purpose of drawing or discharging the coke from the oven; and also certain alterations in the construction of the ovens, in order to adapt parts of such machinery or apparatus thereto.

I use for this purpose what I call a "cold cradle," of which a plan is given in fig. 21. A, B, C, is a square or other shaped rod which is passed through a tube, H, I, K, which may be of either of the forms shown in the cross-sections, G and N, (fig. 22) or of any other suitable form, and then through an aperture in a back draw plate, D E, set on its edge, beyond which it terminates in a screwed end, to which a nut, F (fig. 23), is fitted. The rod, A, B, C, and draw-plate, D E, may be connected in any suitable manner. The mode in which I use the apparatus is as follows:—Either before, or during the charging of the oven, I place the tube, H, I, K, (detached from the other parts) on the floor of the oven, as represented in fig. 10* of the first set of engravings before described, and leave it there during the process of coking. When the process has been completed, and it is desired to discharge the coke, I remove the tiles and bricks, F^2, *f*, and G, from the front and back of the oven (see fig. 4) and insert at the opening, W, (fig. 2), the draw-plate, D E. I next pass the rod from the opposite end through the tube and back-plate, and make it fast by the nut, F, after which I attach a rope or chain to the eye at the near end, A, of the rod. The "cold cradle" is now ready to be drawn forwards, in which position it is represented in fig. 11, and when drawn forwards it brings of necessity along with it, the whole of the mass of coke within the oven. I call it a "cold cradle" because the parts, namely, the rod and draw-plate, which are most liable to tear and wear (especially if used in a heated state) are not left in the oven during the process of coking, and are exposed to the heat only when in actual use, and while yet in a cold state. The tube suffers nothing, because it is completely enclosed in the coke, and thus protected from oxidation, besides which it is always in a state of rest, and not subjected (like the rod and draw-plate) to tension or deflection, or other disturbing force of any kind.

Instead of using a tube through which to pass the rod, passages for it may be made in or on the floor of the oven, as indicated by the letters *g* and *p*, in figures 1 and 2, or in the side walls at *m* and *n*, in fig. 6*, or in any part part of the side walls above *m* and *n*; these passages being open at the sides next the oven, and covered during the process of coking, by pieces of angle iron, or other material. But I prefer the tube, as being on the whole attended with the least trouble.

Instead also of the mass of coke being drawn out of the oven it may be pushed out by applying a rod to the back of the plate D E; but there is a practical disadvantage attending such an inversion of the process. When the drawing out plan is followed, the coke can be drawn out to any distance from the oven, on to the floor in front, there to be watered and cooled, without the least inconvenience, but to push out the coke to the same extent from behind, it would be requisite to use rods of such a length, that they would be difficult to handle and exceedingly liable to become warped.

When ovens are built back to back (as is sometimes the case), and the introduction of the draw plate at the back is thereby rendered impracticable, I use a drawing apparatus of the description represented in figs. 24 and 25. D E, is a draw plate, as before, which is placed at the back of the oven before charging; and H I K, fig. 21, are two tubes, which are also, before charging, laid on the floor of the oven, parallel to each other, or in any suitable position with respect to, and at a distance apart conformable to the width of the oven. Both the tubes and draw-plate remain in the oven during the process of coking. On proceeding to draw the oven, the rods, *a a*, are passed through the tubes, H, I, K, and through two sockets or bosses, *i*, *k*, *m*, in the draw-plate, of the form represented on an enlarged scale in the section fig. 25; and to the inner ends of the rods, *a a*, short cross pieces, *c c*, are attached, which on being turned half round catch hold of the draw-plate. After the rods are in their places, a connecting-bar, or brace, *d*, is passed through eye-holes in the near ends of the rods, and a rope, or chain, *e*, is attached to the centre of the brace, *d*, by

means of which the apparatus and the coke along with it are drawn out of the oven. Some time I make the draw-plate D E (which is here stated as being left in the oven during the process of coking), hollow and keep it supplied with water by inlet and outlet pipes, which can be connected or removed from the draw-plate at pleasure. The water keeps the plate cool, and prevents the rapid destruction which a solid plate would be liable to.

Fig. 24* exhibits a modification of a coke-discharging apparatus, which is kept cool by the flow of water through it. The apparatus is represented in the figure partly in section. It consists of three inter-communicating tubes, firmly united and arranged in the form of an isosceles triangle, the two equal sides of which terminate in eyes, through which a connecting-belt, *g*, *h*, is passed, having an eye, *o*, in the centre, to which a pulling chain or rope is attached; *e*, is an aperture for the admission of cold water, and *f*, another aperture for the escape of the water, or of any steam which may be generated from it in the course of its passage through the tubes. The apparatus is placed on the floor of the oven before charging, with the ends projecting out from the doorway; and the aperture, *e*, is connected by a service pipe, with some convenient head of water, while another pipe attached to the aperture, *f*, conveys away the discharged water or steam.

Another sort of drawing apparatus, by which the rods may be introduced over the top of the coke, is represented in figs. 26 and 27, which last is a sectional view of part of an oven with the apparatus applied to it. The line G denotes the floor of the oven, and the space from G to *c*, the height of the batch of coke which is to be withdrawn. D E, is a draw-plate, as before, which is introduced after the coking process has been completed through an opening, S, made in the back wall, H, K, of the oven, and of nearly the entire width of the oven. The rods, *a a*, are passed over the top of the coke and through holes in the ends of the draw-plate, after which they are made fast behind the plate by pins or cotters, or otherwise drawn towards one another, so as to form with the plate the figure of a triangle. A chain, or rope, or bar, is then passed through the eyes in the two near ends; and by pulling thereat the apparatus along with the entire batch of coke is withdrawn. W, in fig. 27, indicates an opening at the back of the oven, as in figs. 2 and 4; but when I use this particular description of drawing apparatus, I generally keep this opening closed; *b*, in the same figure, is one of the air-flues.

Instead of attaching a draw-plate through the back of the oven, as in the preceding apparatus after the coking process has been completed, a horizontal, or flat plate, may be laid on the floor, quite at the back of the oven, previous to charging, and left there during the coking process; and then each rod may be made with a prong projecting from one end, which prong would be flat while the rod was being pushed over the coke (after completion of the coking process), but could by a quarter turn be turned round into a vertical position, so as to penetrate behind the mass of coke, and take into any one of a row of holes or pins, made in or on the back edge of the draw-plate.

Some kinds of coal during the process of coking shrink, or part from the back wall of the oven, so far as to allow of a draw-plate being introduced from above, between the coke and the back wall, in which case no opening in the back wall is required, and an apparatus may be used similar to the one described in fig. 26, but having the rods and draw-plate firmly united together, after the manner of a common rake or hoe.

Fig. 28 is a view of the sort of apparatus which is in common use for drawing coke ovens, and is merely given here in order to exhibit more clearly the improvements which I have effected. All the parts of this apparatus are firmly united together by welding and cottering, and it is inserted entire into the oven before charging, and remains there during the process of coking. The inevitable consequence of this is, that the whole of it is raised to nearly a white heat by the time it is required to be made use of for drawing out the coke; in which state it is ill qualified to withstand the great strain to which it is necessarily subjected. And though in the first instance, the draw-plate, *r*, *s* is, like the rest of the apparatus, covered and protected by the coal or slack; yet, in the course of the coking process, the coal and slack shrink towards the centre of the oven, and part from the back and side walls, leaving an open space all round, through which the atmospheric air enters, which, acting on the draw-plate in its highly-ignited state produces a most destructive degree of oxidation. From these various causes this apparatus becomes very rapidly worn out and unfit for use, and forms a large item in the cost of manufacturing coke. But with any of my improved descriptions of drawing apparatus, the greater part of that waste and consequent expense is entirely avoided, because in each case the principal parts are only used in a cold or very slightly heated state.

(To be concluded in our next.)

POSSIBILITIES AND PROBABILITIES IN PHYSICAL SCIENCE. BY A. M.

Sir,—The recent experiments of M. Boutigny (whose former discoveries on the "Spheroidal State of Bodies" I brought before your readers about two years since) by which it appears that a man may, with impunity, plunge his hand into masses of molten metal—thus confirming the substantial truth of many old stories about the fire ordeals to which suspected witches were exposed—afford me an opportunity of making some remarks on the subject of "credulity" and "incredulity," "possibility and probability" in physical science, which I have, for some time, been intending to lay before your readers.

Of all the absurd notions that ever were prevalent, none can be more absurd than the now so prevailing idea, that it is *more philosophical* to be *incredulous* than to be *credulous*, to *disbelieve* than to *believe*, in *all cases where the evidence is not absolutely demonstrable*. When semi-educated and self-conceited smatterers turn up their noses on hearing things which lie out of the sphere of their small knowledge and experience, they act on this principle. Can anything be plainer, however, than the fact, that it is just as weak-minded and silly to *disbelieve* without examining the evidence, as to *believe* without doing so? The whole history of science, if it shows anything at all, shows this—that the great mass of the learned and scientific "authorities" in every age, especially royal academies and societies, have obstinately and stupidly *refused to examine* the evidence for any new facts or doctrines which were at all opposed to or beyond the "orthodox" scientific creed of their day. To most of your readers this must be already too well known to render it necessary here to recount over again, for the hundredth time, the histories of the various discoveries of the circulation of the blood, vaccination, lightning-conductors, gas, &c., &c., every one of which was declared over and over again by the chief authorities of their day to be absurd, impossible, ridiculous, or diabolical. No man in his senses will conclude from these facts that any new doctrine is true, simply *because* it is thus opposed and rejected by the academic and other chartered authorities of the time; but every one is fully justified in concluding that the opinion of these bodies is, as a general rule, good for absolutely nothing at all, whenever such doctrines or facts are concerned. The bigotry and narrow-mindedness of scientific men is quite as notorious, and much less excusable, than religious bigotry.

We have had a most memorable instance of this, in our own days, in the history of mesmerism. In a subject confessedly so little understood as the physiology of the nerves, the very men who at one moment confess their almost total ignorance of its laws, are found the next obstinately refusing to examine with their own eyes and ears the new phenomena; nay, flatly denying the possibility of things, which hundreds and thousands of persons have declared they themselves have witnessed; and which the self-conceited denier will not even take the trouble to look at for himself. It is really astonishing, that self-conceit and complacency in his own petty knowledge, can so influence a man as to make him give the lie direct to thousands of his fellow-men, as sensible and as able as himself to detect trickery or imposture. But however astonishing it may be, it is nothing at all new. When Galileo begged and prayed the "orthodox" professor of astronomy, at Padua, only first to come and look through his telescope for himself—No! he—the orthodox authority of *his* day—couldn't think of such a thing! He was perfectly and absolutely certain that Galileo *must* be either deceived or a deceiver, and therefore it was derogatory to his dignity to look through the telescope.

It is not recorded whether this wiseacre went so far as one of the medical "authorities" in Paris a few years since, who solemnly declared that, with regard to the phenomena of mesmerism, even if he saw them with his own eyes he wouldn't believe them! Many who are not quite of so original a cast as this French worthy, who have condescended to witness some of the facts for themselves, have acted scarcely less absurdly. For instance, some of the members of the first French commission appointed to examine mesmerism, when they found it impossible to deny *the facts* they saw, fell foul of the *theory* which Mesmer had

framed to account for them. As if, forsooth, the truth or utility of the facts depended on the theory! If this be so, let us give up all further experiments in electricity, magnetism, heat, &c., seeing that there are so many different theories to account for them; and that this difference is of itself proof positive that the facts themselves must be all false, useless, ridiculous!

The mesmerists assert that, by their methods they have cured thousands of diseased persons to whom other means had been in vain applied—that surgical operations had been performed on hundreds, and even thousands, without giving them the slightest pain; and many of these long before the discovery of ether or chloroform. Every man, then, one would think, would at least *wish* these things to be true, for the sake of humanity. And if they did so wish, why, the least thing they could do would be to give the thing a fair trial. No such thing! The "authorities" of several hospitals, both here and in France, have actually refused to allow any such trial, even when some of the ablest medical men of the day, and connected with their institutions, have applied for permission to do so, on the ground that they had thus cured several patients already! And so thousands of wretched sufferers have been left to pain and death, through the sheer obstinacy and miserable conceit and bigotry of their humane and Christian guardians. It is difficult to say which inspires most disgust, the narrow-minded bigotry or the inhumanity of such people.

Before quitting this subject of mesmerism, I will take the opportunity of recommending those of your readers who are yet strangers to it, or disbelievers in it, *to examine for themselves.* The evidence for it, even in the deficient and crude state in which it was presented to Laplace and Cuvier, sufficed to convince *them*; and since their time, it has gone on with such strides that at the present day the evidence is more full, complete, and satisfactory than for any other non-mathematical science whatever. Of course, experiments fail occasionally in this as in every other branch of science; and there has, perhaps, been quackery and humbug in some public lecturers. It is nothing but natural that a subject so full of wonders should have induced some ignorant and unprincipled men to make a trade of it, and go about the country giving absurd lectures and good-for-nothing exhibitions. These men bring discredit on the whole affair—yet why should they? I have heard as great lies and as prodigious foolery in some *popular* lectures on natural philosophy, even in astronomy, as ignorance and impudence could concoct. Does this reflect any disgrace on *those subjects*? But the only proper place to *study* the phenomena of mesmerism is in private: it is utterly impossible, from the very nature of the theory, that public exhibitions can be so satisfactory and unexceptionable, as those private ones in which you are familiar yourself with all parties concerned, and can test everything for yourself. It may be sufficient to add, that mesmerism was *recognized* as a branch of medical practice by the Prussian Government as far back as 1817: that in 1818, the Berlin Academy of Sciences offered a prize for the best treatise on mesmerism; and that shortly after, a committee appointed in Russia by the emperor, declared it to be a most important agent. The committee appointed by the Royal Academy of Medicine in Paris, also, in their Report of 1831, fully acknowledged its truth and importance; and it is asserted (whether truly or not, I cannot say), that the great majority of medical men in Paris are now in the habit of employing it in their practice where advisable. In this country, the medical journals have run nearly through the accustomed course—first of utterly neglecting it, then flatly denying it, then confessing *there might be something in it*, then acknowledging the truth of *many* of the facts (only to save appearances, and keep up their own credit as the only wise men in such matters, they hatch up a little theory of their own to *account* for the facts), and lastly, fully surrendering (but this last stage has not yet been reached by many—they will come to it, however, before long.) The works on the subject are innumerable. Perhaps Sandby's "Mesmerism and its Opponents" and Lang's "Mesmerism," are as good introductory books as any. The Bengal Government, a few years since, ordered that the army surgeons should study mesmerism for some time under Dr. Esdaile, previously to joining their regiments. This was in consequence of

a series of painless surgical operations performed by Dr. Esdaile, which may be read in his work—"Mesmerism in India."

When the reader has become convinced of the truth of the mesmeric phenomena, he will next be perhaps surprised to learn that they have been known and practised in almost all ages and by all nations. We have traces of it—some as clear and plain as daylight, others more obscure—in the classical writers—in the literature of the eastern nations, and of the middle ages; also amongst several savage tribes in Australia and elsewhere at the present day. Now all these indications have, up to within the last few years, been neglected, and treated as mere old wives' tales and nonsense. And this same neglect and contempt of everything foreign to our own short-sighted and limited experience, has extended its baneful influence over numberless other subjects as well as mesmerism. The accounts in Marco Polo and other old travellers were for a long time derided as fabulous—many, if not all of which, have been proved to be true by more recent travellers. Modern geological discoveries have restored credit to many relations hitherto set down as ridiculous. The modern experiments and observations in electricity and meteorology have also proved the substantial truth of numberless accounts in ancient writers, which the wise men of the last century chose to laugh at as absurd, simply because their own limited knowledge made them appear strange and marvellous.

Indeed it may be safely asserted, that out of all the strange stories and marvellous incidents related by ancient authors, travellers, &c., at least two-thirds are *absolutely* true, and by far the greater portion of the remainder are *substantially* true—that is, may be coloured, and more or less exaggerated, but are on the whole faithful records of real events. The *purely fictitious* accounts are exceedingly few, and can almost always be very easily detected—*not* by their *marvellousness* (for this is no valid ground for rejecting anything, unless we are self-conceited enough to imagine we know everything in the universe, and therefore are fit judges of what is possible and what not), but by their want of clearness, distinctness, and by the absence of those marks of sincerity and conviction in the writer, which are so easily perceived and felt in all those narrations, of the truth of which the writer is himself thoroughly convinced.

Indeed, we might almost venture to challenge any one to produce from the whole of history, ancient and modern, any one narrative, by *eye-witnesses*, which can be proved to be totally false and unfounded in fact, except in those cases where there were interested motives and inducements to lie. In accounts of natural phenomena, such motives and inducements can, from the nature of the thing, have scarcely any place. It is natural to man to tell the truth in such matters; and the most that can ever be reasonably objected to them is, a greater or less degree of exaggeration. There is only one thing that requires caution, and that is, to distinguish between the relation of the facts or phenomena themselves, and the *opinions of the writer as to the cause or nature of these phenomena*. Thus, for instance, no unprejudiced man, who has ever read any considerable number of the trials for witchcraft, can doubt for one moment the results of most if not all of the facts related; but as to the *supposed cause*, viz., demoniacal possession, or any other, it is quite another matter. The supposed witches often declared most solemnly that they had been carried through the air to a meeting of witches with the devil (which they called a "Sabbath"), and described vividly what took place at these meetings.

Now, it was found in several instances, that the accused parties themselves gave the same account of their having been in the night to a "Sabbath" of this sort, when all the night they had been confined in prison and closely watched! The fact was, that by means of certain stupifying drugs and ointments, visions of a most extraordinary kind were produced, which the poor deluded "witches" took for realities. Now here, then, there was no *imposture*—no *lying*; the "witches" really believed they had been to such a "devil's Sabbath;" and the unprejudiced and cautious inquirer is led to the discovery of new and unheard of properties in certain herbs, ointments, &c. Whereas, if he had chosen to flatly deny the veracity of the accused, and set down everything as mere imposture, this discovery would not have been made. This

is a good example to illustrate what we have been saying. The accounts given by these poor women are in themselves improbable to the highest degree;—granted: it remains to be shown whether they are pure lies, or the result of some strange self-delusion. Many persons would at once pronounce the former, and refuse to inquire into the matter at all; others would consider the latter explanation more likely, but equally refuse any further inquiry as to the *origin* of this delusion.

Both would thus fail in obtaining any satisfactory explanation of these strange events. The only rational and philosophical way is, first, to inquire whether any interested motives for deception can be traced; and if not (as there could not be, obviously, in the witch confessions), to assume the sincerity of the narrators, and their full belief in the truth of what they stated; and lastly, to inquire, whether the things asserted could be themselves true, or whether the cause of delusion can be traced. To take another example. A sailor goes aloft to furl the sails, and comes down again in a great fright, declaring he heard a voice saying, "It blows hard," when he was certain there was no one up there, and that it is not a human voice. A second goes up, and comes back with the same story; and so half the crew are in turn frightened. At last the mate goes up, and discovers that it is a parrot, which has got up and lay hid amongst the rigging. If the cause of their fright had happened not to be found out, it would have been very irrational to accuse the sailors of lying, or even of setting it down to *pure* imagination. There are many things, however, which do not admit of being solved by any supposition of self-delusion, and these, however strange, must be received as true by every unprejudiced inquirer.

I have no hesitation in including in this class the well-known account of certain persons floating in the water, and the difficulty of submerging them, given in various trials for witchcraft, and elsewhere. In the "Collection of Criminal Trials in France," by Pitaval, there is an account of several persons, who being suspected by their neighbours of witchcraft, and who conscious of their own innocence, begged and entreated this trial, or "ordeal by water," in order to clear themselves from all such suspicions. Accordingly they were so tried, and, to their own great amazement, many of them could not without difficulty be sunk under the surface, although perfectly naked. Thousands of spectators were witnesses, and amongst others, several of the law-officers and judges sent down to conduct the trial. Luckily for the poor people thus tried, the authorities were not convinced, even by the strange phenomenon, that it had anything to do with witchcraft, and so liberated them, and gave strict orders that no such trials or ordeals should be practised in future.

Now, is there anything more absurd, more extraodinary, more incredible in this than in the accounts of the fire-ordeal? Is it not in the highest degree incredible, and contrary to all known laws of heat, that a man should plunge his hand and arm into melted iron or other metal, and draw it out uninjured? Can anything be more monstrously absurd (it would have been said ten years ago) than the idea of ice in a red-hot crucible? If then the discoveries of M. Boutigny confirm the truth of one absurdity, impossibility—why are we to disbelieve the other alleged fact? It is certainly contrary to the law of specific gravity that a human body should experience that degree of resistance to sinking in water which the account above referred to asserts. But is it not equally contrary to this same law that cold iron should float in melted iron in the way so well known, and about which there was considerable discussion in a former volume of this Magazine? We know that gravity never ceases to act; and that so far as this goes, no human body can ever oppose much resistance to sinking in water; but we also know that electrical conditions of the body sometimes exist, which render it probable that an "atmosphere of repulsion" surrounds the body; and thus, notwithstanding the downward force of gravity, the body *might* be kept by the stronger force of electrical repulsion from sinking. It is not here asserted that such electrical conditions *did* exist in the cases above mentioned; all I say is, that it is more rational to believe the truth of those accounts, and account for them in this way, than to flatly deny them.

A similar thing occurred quite recently (not more than fifteen or twenty years

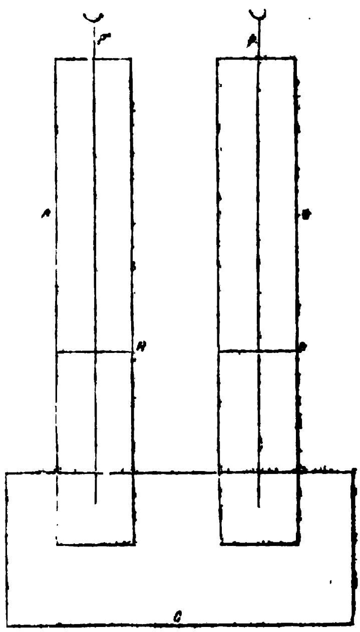
since) in the practice of Dr. Justrius Kerner, at Weinsberg, in Germany, in the case of one of his patients, a Madame Hauffe: "When she was placed in a bath in this state, extraordinary phenomena were exhibited; namely, her limbs, breast, and the lower part of her person, possessed by a strange elasticity, involuntarily emerged from the water. Her attendants used every effort to submerge her body, but she could not be kept down; and had she at these times been thrown into the river she would no more have sunk than a cork."

Of these, and all other such *extraordinary* phenomena, it may be safely asserted that they deserve carefully inquiring into, and the investigation will frequently bring to light many laws of nature, which, from the rarity of their manifestation, are not the less real. This, indeed, is the object of the present paper; to induce your readers to treat marvellous accounts in a rather less summary way than is often done. To believe implicitly in them is silly and ridiculous, but equally silly and ridiculous is it to deny their possibility and reject them altogether. The only rational course is to act as a policeman does toward *suspicious* characters, take them up and submit them to a cautious but impartial examination. *Suspicious* facts should be treated in the same way. But *cowardice* frequently prevents the guardians of truth and scientific justice from doing their duty, as well as police-officers and magistrates from doing theirs. If a man is afraid of being laughed at for avowing his belief in extraordinary things which lie out of the "orthodox" creed, his conduct is sure to betray it. He will not calmly listen to the evidence for fear of being convinced; or if he ventures to inquire a little into it, and finds more than he can account for on his old hum-drum principles, he forthwith runs away and shuts his eyes and ears, lest his jog-trot habit of thinking and rusty systems of philosophy should be disturbed beyond remedy. And yet what can be more thoroughly contemptible than a whole crowd of self-styled philosophers running away in sheer panic from a new fact or discovery; turning round, however, every now and then to peep at it, and hiss and abuse it; and all because they can't find room for the poor unfortunate stranger in their little petty box of ideas and doctrines? Can any cowardice be more despicable than that which makes a man afraid to have an opinion of his own, or to speak it out boldly; because, forsooth, a set of other men, perhaps still more weak and ignorant than himself, might laugh at him for trusting to his own senses in preference to *their* theories?

A. H.

DESIGN FOR AN ECONOMICAL GALVANIC BATTERY.

Fig. 1



The rendering galvanic batteries as economical and efficient as possible has necessarily much to do with the successful introduction of electro-magnetic power as a rival to steam. I have long thought it possible that a gas battery might be made to compete with any other for economy, constancy, and ease of management; but my time being fully occupied in business, and being obliged to make every part of my apparatus myself, I have hitherto been unable to make my ideas the subject of conclusive experiment.

Fig. 1 represents a Grove's gas battery; A is a glass tube filled with hy-

Fig. 2.

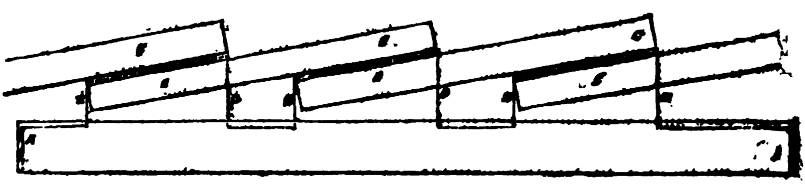
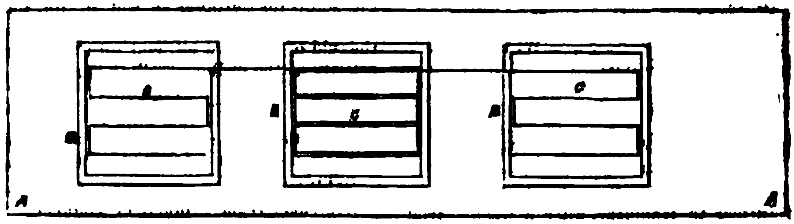


Fig. 3.



drogen up to H; B is another tube filled with oxygen to O; P P are strips of platinum; the lower vessel, C, and the tubes to H and O, are filled with acidulated water. The efficiency of any battery, I believe, is proportional to the extent of the surfaces of action and to their proximity. As an economical battery, Grove's seems very defective, as the surfaces of action are only the breadth of the platinum where the liquid touches it at H and O, and these points are also at a considerable and constantly increasing distance. I propose to avoid these objections by the following arrangement, of which fig. 2 is a section, and fig. 3 a plan. A A is a tray made of gutta percha, with the ends and sides turned down and rendered air-tight; B B are square projections or cells, there being a hole hardly so large as the cell through the tray; C C are strips of platinum, which can be kept in the zigzag form by pieces of gutta percha (not shown in the figures). These strips are arranged so as to overlap each other, as represented in the section, passing air-tight through the cells at D. Diaphragms of bladder or leather are fastened tight over the cells, as represented by the dotted lines in the section; the platinum presses against each side of these diaphragms, although it is not so represented in the figure for the sake of distinctness. The tray being now placed in water, hydrogen supplied under it, and the diaphragm moistened with acidulated water, the platinum in the cells under the diaphragms will be exposed to hydrogen, while the upper portions of platinum will be exposed to the oxygen of the air, and the diaphragms will supply the place of the liquid—or, in fact, will be the holders of the liquid. Thus, a considerable extent of platinum could be brought into action, and the points of action would be brought very near each other, only the thickness of the diaphragms intervening.

I have concluded that the atmosphere would furnish an effectual supply of oxygen, from a paper on the Gas Battery in the *Electrical Magazine*, some time since. This battery could be kept in action any length of time by keeping up the supply of hydrogen. Another application of the oxygen of the air, I have thought, could be made by substituting it, for the nitric acid in Grove's nitric acid battery. Take a diaphragm, such as those used for Daniel's battery; wind tightly round it platinum, or platinised silver wire, place a bar of zinc in it, and fill it with dilute acid. Immerse this arrangement in water, and connect the platinum and zinc—bubbles of hydrogen will be evolved from the wire. Immerse it in nitric acid, and now the hydrogen, instead of escaping as a gas, will decompose the acid, and combine with a portion of its oxygen. This would render

Grove's a very powerful battery. Remove the arrangement from the acid, the platinum will now be exposed to the air, only having a film of moisture on it; and if platinum in the gas battery will cause free hydrogen to combine with oxygen, will not the nascent hydrogen in this case unite with the oxygen of the air, and thus fulfil all the requirements of the nitric acid in Grove's battery, which seems to be useful only in preventing the hydrogen assuming the form of gas?

I am, Sir, yours, &c.,
W. Symons.

Dunster, July 20, 1849.

THE SCREW AND THE PADDLE.

(From the *Plymouth Herald*.)

The *Basilisk* and *Niger* steamers lately returned to Hamoaze, after a week's trial of the comparative merits of the paddle and the screw as machines for propelling ships, and it has been found that in these vessels (which are as near as possible alike in form, horse power, and sails), the screw is equal to or superior to the paddles, whenever the respective boilers of the two vessels generate an equal quantity of steam at an equal density. The boilers of the two vessels are very unequal in power for generating steam, there being a deficiency on board the *Niger* screw-vessel, where, the machinery being fixed in her bottom, beyond the reach of shot, her tubular boilers are so low that the fire has to descend among the tubes. Now, we are informed that in the higher parts of the boilers there is an excess of heat, but in the lower parts a deficiency, and hence the want of steam and a waste of coal, which a better arrangement of the flues might obviate. These experimental trials will be of great value, and in the end prevent unnecessary expense. The facts obtained are—1. That whenever the two vessels' engines work up to the same amount of horse power, the screw propeller obtains the highest velocity. 2. When the vessels are fastened stern to stern, the screw has the mastery over the paddles, by dragging the paddle vessel stern foremost. 3. The screw and its necessary machinery are entirely under water, and thereby protected from shot, whilst the paddles and machinery are very much exposed. 4. The paddle vessel mounts six guns, whilst the screw vessel mounts fourteen guns. 5. The *Niger* has great superiority as a sailing vessel over the *Basilisk*, and in no circumstances would be in danger by loss of machinery, as is the case with paddle vessels on a lee shore. The power which the screw propeller transfers to the helm is of primary importance in ships of war, by quickening manœuvres in confined spaces, whilst the paddle vessel requires as great space as a three-decker to turn in. Independent, then, of other manifest advantages, such as a broadside of artillery, a double capacity for sails or machinery (and the machinery being under water), which the screw vessels possess, the power of quickly turning would, or rather should, lead us to give a preference to the vessel propelled by the screw for purposes of war or for long sea voyages, which might be made without the aid of steam at all, and with the same celerity as the ordinary sailing vessel.

LAW OF PATENTS.—REPORT OF THE COMMITTEE ON THE SIGNET AND PRIVY SEAL OFFICES.

Extracts from Minutes of Evidence.

(Continued from page 139.)

Mr. J. C. Robertson Examined.—That hearing is of a more formal nature than the hearing before the Attorney-General, is it not?—Yes, much more so.

And there is not the same necessity for secresy, inasmuch as the patent has been already disclosed?—There is no necessity for secresy before the Privy Council at all.

On that account the proceedings are of an essentially different nature?—Yes.

Are you acquainted with the French law as to patents?—Yes, I am.

Do you think that any part of the French regulations can be advantageously introduced into this country?—In France every patentee pays so much per annum, and if that system were adopted here I think it would produce much more revenue than our own.

Do you think it desirable that a tax should be paid by annual instalments rather than by a gross sum in the first instance?—Yes. In France if a patent does not turn out well, the parties drop it altogether. There is a day appointed for the payment of the annuity, and if it is not paid the patent falls; and that system gives a man an opportunity of dropping it if he has been mistaken in his views.

Is not the result of that mode of payment this—that the Government only gets the entire sum upon the successful patents?—Yes.

In that manner the Government must lose a great deal of revenue?—Yes, put in that way; but successful inventors here would be very willing to pay a per centage

on their receipts. There is a universal feeling entertained of this kind. It is repeatedly said that the Government might get a very large revenue from successful patents.

Would not that system of deferred payments lead to a multiplication of patents?—No doubt it would have that tendency.

I think you stated, a short time ago, that you considered a multitude of patents an evil?—Yes; but I have recommended, at the same time, that the Government should interpose a check to that, by causing each application to pass through the sieve of some official examiner, assisted by such men of science or skill as he might see fit to call to his aid.

Then you would, in fact, substitute one obstruction for another:—Yes, and some obstruction there ought to be. I think if every person who supposed he had invented something new, were entitled to a patent for it, great inconvenience would result.

Do you think that the present mode of granting patents gives satisfaction?—Quite the reverse, very general dissatisfaction.

What are the chief circumstances in the present system which are complained of?—Firstly, the great expense; secondly, the delay in obtaining a patent; and thirdly, the enormous expense of vindicating a patent right.

The last objection is not connected with the mode of granting the patent?—Not at all.

The main objections, then, to the mode of granting a patent are the expense and the delay?—Yes.

Would those two objections be removed by the adoption of the change you have suggested?—Yes, I think so, always assuming that if patents are to be made cheap, they shall be subjected to a stricter supervision than at present. I think the Attorney-General should be assisted by some person in the character of an assessor. I should prefer a single assessor to a Committee of any kind; an assessor who should investigate every application for a patent, and use some discretion in passing it.

Does the subject of patents attract much attention amongst practical mechanists and engineers?—A great deal of attention. The general feeling among mechanics and manufacturers, but mechanics particularly, is in favour of cheapening them.

To that principle I understand you to be opposed;—Yes; an observation was made by Sir Robert Peel a long time ago, in the course of a discussion relating to patents, to the effect that, if you made patents cheap, every journeyman in every manufactory in the country would have his patent; and I am afraid there was but too much truth in the remark. The prizes in the patent lottery have been very great, and they are tempting to poor men.

It has been mentioned that it was thought advisable that a patent should date from the first day of the presentation of the petition. Do you see any advantage in that?—Not much, because we are to suppose the period to be shortened in getting a patent, reduced, say, to a period of 10 or 15 days.

You think, during that period, there would be no danger of persons having the means of obtaining an unfair knowledge of it, or defeating it by raising pretensions that they had invented something similar to it? There is a chance of that kind; but I do not think such things happen often. Few cases, I apprehend, could be adduced of persons losing their invention between the time of the application for a patent and the sealing of it, especially since Lord Brougham's Act, which has provided that an invention must have been generally used and known before the date of a patent to render that patent void. It is obvious that an invention cannot be generally used and known within the period betwen applying for a patent and sealing it. Lord Brougham's Act has provided a complete remedy for any misadventure of this sort; the patentee has but to apply to the Privy Council for a confirmation of his patent under such circumstances, and is sure to obtain it; though, to be sure, the application is attended with some trouble and expense.

Note supplementary to Mr. Robertson's Evidence.

I avail myself of the opportunity afforded by the Commissioners of adding a few observations in justification of the opinion I have expressed on the subject of cheapening patents.

The small expense attending the verification of literary copyrights is much relied on by the advocates for abolishing, or at least greatly reducing, the fees on patents. Why, they say, should a man who writes a book be charged only 5*s.* for entering a forty-two years' copyright, and another, who invents a machine, be charged 320*l.* for a monopoly (for all the three kingdoms) of only fourteen years' duration? It is forgotten, in this way of stating the case, that the cost of entry is by no means all the author has to pay. He has to print his book before his title to it can be registered, and this often at an expense much beyond what the inventor has to pay for his patents. The author has to risk this outlay too, just in the same way as inventors have to risk the cost of patents, before he can have any certainty whether his book will take or not. And should he not be

able to print on his own account, he is also under the same necessity, as inventors frequently are, of parting with a share of his property to some bookseller or other person who will defray the cost for him. Nor is it commonly easier for the man of letters than for the inventor to find monied patrons. Good books have gone quite as often a-begging as good inventions; perhaps oftener.

Between books and inventions there is this further important distinction: a book, if it be worthless, falls dead-born from the press; but not always so with a useless patented invention—it may exist for evil if not for good. It happens very often that an invention is patented which by itself is good for nothing, but which, if it had something altered in it, or something added to it, would be extremely valuable. No one, however, is at liberty during the subsistence of the patent to supply what may be wanted, without the leave and licence of the patentee; and knowing this, many who could do so readily, are deterred from making the attempt. The patentee may be well enough disposed to welcome a helping hand; but, as things are, no one offers it. And then this result follows, that the course of improvement in the particular department of arts or manufactures to which the invention relates, is wholly stopped till the patent expires, which may be close on half a generation. It is settled law, to be sure, that if an invention is, in point of fact, good for nothing, the patent for it is also good for nothing; but there must be a process at law to have that declared, a process of *scire facias*, which even in the plainest cases is one attended with great expense; and it is not often that persons are to be found willing to incur such an expense for the sake of any speculative advantages to be derived by themselves or others from the repeal of a patent. The course commonly preferred by persons having an improvement on a patented invention, is to wait till the original patent expires, or is on the point of expiring, and then to secure the improvement by new letters patent. Again, the patented invention may be not merely something original though defective; something good in principle, though practically useless, but something as old as the hills, and of which the public have from time immemorial been in the free exercise and enjoyment. No matter whether the patentee has taken out his patent in ignorance of what others have done before him, or with a fraudulent design of appropriating to himself a portion of the common property of the public (I have known instances of both sorts), the costly process of *scire facias* is as necessary in the one case as in the other. You must either get rid of the false pretender by getting his patent annulled, or stand the chance of an action at his instance for infringing it. Now, for one party injured by such false pretensions who will contest them at law, there are hundreds who will purchase forbearance at any reasonable price. The patent pretender has only to be moderate in his demands to drive a very thriving trade.

I offer these as sufficient reasons (though not all that might be urged) for pausing before giving the same pecuniary facilities to the passing of patents for inventions as for registering the copyright of new books. If there could be any Commission so constituted as that no invention of an impracticable character, nor any invention which was old, would be likely to pass its ordeal once in a dozen times or so, I should be inclined to recommend that all fees on patents should be done away with beyond what might be necessary to produce a revenue adequate to cover the expenses of a well-regulated Patent-office; but I have never heard of any plan for the formation of such a Commission which was not open to insuperable objections, and I despair of seeing any. Such Commissions have been had recourse to in other countries,—Prussia, Belgium, and the United States, for example,—but nowhere have they given satisfaction. The number of objectionable patents is just as great where such Commissions exist as where they do not. I am forced therefore to fall back on the pecuniary test as being, though of a vulgar sort, the very best which the circumstances of the case allow of. When any considerable sum of money has to be paid for a patent (as for anything else), it naturally induces hesitation, inquiry, and reflection. Even the most sanguine discoverer of a new thing will pause before he indulges his vanity or self-esteem at the expense of his pocket; and it is good for himself and his family that it should be so. If he has recourse to some capitalist to advance the money for him, that capitalist is very sure to inquire of some third persons, more or less competent to advise him, as to the originality and worth of the invention; and so in this way also the chances of needlessly encumbering the Patent Rolls become diminished. Take away the money check, and you will take away every motive for hesitation and circumspection. Every one who fancies he could make anything by a patent, would have one; and so in the end we should have Sir Robert Peel's imaginary case more than realized,—"every journeyman in every manufactory in the kingdom" with his patent, and every manufactory crippled, if not stopped, in its operations by a host of im-

posthumous claimants, two or three of them perhaps the authors of inventions of real utility, but the majority, most certainly, of the class of mere dreamers and obstructives.

Patents are very cheap in the United States (30 dollars); and if excessive cheapness were so essential as some contend to the development of the inventive genius of a people, we ought to expect to find a much greater number of important inventions on the Patent Rolls of these States than anywhere else; but the fact is notoriously the reverse. The majority of American patents are of a very trivial character, and not at all to be compared for average importance with those of England, where the cost is forty-five times greater.

It is certain, too, that excessive as the cost of English patents undoubtedly is, it has not prevented England from taking the lead of all other nations in mechanical inventions. On the contrary, nearly all the great inventions which have raised the manufacturing industry of this country to so unprecedented a pitch of prosperity, have been the subject of patents. Witness the stocking-frame, the spinning-jenny, the water-frame and throstle, the steam-engine, the power-loom, the self-acting mule, the hot-blast. If there had been many instances of valuable inventions being lost to the country through the cost of patents, it ought to be an easy task to bring forward a collection of them in support of the plea for cheapness; but I have never seen any such collection, and I cannot myself call to mind a single well-authenticated case of the sort.

If the expense of patents should be reduced to any considerable extent, I would recommend that each patent should be limited, as in France, to one substantive matter. The practice at present is to crowd as many things into one patent as the words of the title can cover, and to make these words as vague, large, and comprehensive as possible; a practice arising, no doubt, out of a general feeling that the cost of a patent is too high, and that where so much is exacted it is but fair to get as much as people can for their money. The consequences of this state of things are, however, very pernicious. The specifications of such multitudinous patents become necessarily of great length, so much so as to place office copies of them quite out of ordinary reach, costing very commonly from 10*l.* to 20*l.*, and not unfrequently as much as 50*l.* and 60*l.*, and increasing enormously the expenses of any legal proceedings of which they may happen to become the subject. Again; one man pays no more for a dozen inventions than another does for one or two; and, hence, not only a great inequality in the pecuniary operation of the existing system, but a serious loss to the public revenue. Were each patent to embrace one subject matter only, I think it likely that even though the cost were reduced to about one-third of its present amount (as I have proposed), the aggregate receipts from this source would not be at all diminished.

Thomas Webster, Esq., Barrister-at-Law, examined.

I believe you are the author of a treatise on the Law of Patents, and you have also reported some cases?—Yes: I made first, about the years 1838 to 1840, a collection of all the cases that had occurred; and, having obtained as much information as I then could upon the subject of patents, I embodied it in a book published in 1839. Since that time I have published a collection of reports in a volume—which I see you have here—of cases; and I have just published a pamphlet on the subject-matter, and on the title and specification of patents, relating also to the subject of the copyright of designs.

In compiling those works, has not your attention been necessarily called to the general question of the state of the law respecting patents?—Yes, it has a good deal. I may say that when I compiled the first work it was of a smaller size and character than perhaps would have been advisable, because I found the state of the law, on many points, in so much uncertainty that I thought it would not be prudent to do much more than to present the practical forms with notes, and a very general review and outline of the principles: I followed that course. I may say that the law has, from the number of fresh cases, latterly become a good deal more settled. I was then led to publish a selection of the principle cases. My attention was directed very much to defects which certainly existed; I should say more in the practice than in the principle. I think the principles of the law are pretty well settled now.

. . . .

I do not think that the law of patents, as far as it is contained in the statute of James, and has been expounded by the Judges latterly, does require much alteration; but I think the alterations that may be necessary are confined very much to the practice.

When you speak of the "practice," do you mean the mode of granting a patent?—Yes, I mean the machinery, beginning with the Secretary of State's Office and ending with the Great Seal. . . . .

To follow a patent through its several stages, commencing with the first application to the Crown, which is sent to the Home Office, do you see any objection to that mode of originating the proceeding?—None whatever. . . . .

The next stage is a reference from the Home Office to the Attorney or Solicitor-General; do you approve of that stage of the proceedings?—Yes.

The first stage at the Home Office is very little more than matter of form in that case?—The first stage, as I understand, is nothing more than mere matter of form, the presenting a petition and declaration, and then that becomes a record.

It is a stage on its way to the Attorney-General?—Yes; and inasmuch as it is mere matter of form, I think that stage ought to be a little expedited. It occasions, as I have been informed, a delay of three or four days.

Are you aware of any patent having been refused, and the application not sent to the Attorney-General?—No.

Are you aware of any difficulty that would arise from making the application immediately at the Attorney-General's Office?—No. . . . .

Do you see any objection to a reference being made to the Attorney-General for his report upon an application being made to the Crown?—None whatever.

Are you cognizant of the proceedings which take place before the Attorney-General at the report?—Yes, I am; but I may say that, before it comes to that stage, a party may be stopped by a caveat.

You are aware that a general caveat may be lodged with the Attorney-General at the report?—Yes, I am.

Is there any part of that proceeding which appears to you susceptible of improvement?—Yes; I think the present system of caveats highly objectionable, and that it does not attain the object at all in view. Any party may lodge a general caveat, a caveat with a general title, without specifying against whose application he is lodging it; and the consequence is this, that parties who are interested in particular branches of manufacture—take, for instance, the lace trade—have been in the habit of having a general caveat, in order that they might have an opportunity of opposing anybody applying for a patent, and might know what was going on in that particular branch of the trade. I was informed, only yesterday, of a person who had been opposed, as he said, simply to discover what he was about. Instances of persons being opposed for such reasons, and for the sake of delay, are said to be common.

Is not the result of a general caveat a notice against all the world, and not a notice against any individual in particular?—No doubt it is.

Are not all caveats lodged with the Attorney-General at the report, caveats against a particular invention, and not caveats against the proposal of any particular person?—Yes; and I think it fails entirely in attaining its object as a notice to all the world; because it is a matter of very common occurrence that a party who is very much interested in a particular manufacture finds it worth his while to have a patent always lying at some subsequent stage—say at the Great Seal; and a person who has brought a caveat in at a subsequent date to that gets no notice of such patent. I recollect, three or four years ago, a case in which certain parties who were interested in a very extensive manufacture, connected with the manufacture of candles, consulted me as to whether they had any remedy. They said they had had a caveat. I do not recollect the title, but it was some general title, which they thought large enough to get notice of anything affecting them; but they had no notice of a patent that was granted for a similar title. They found afterwards, on inquiring into it, that the fault did not rest with the Attorney-General's clerk, but that there had been a patent at the Great Seal, lying there for eighteen months, and which the party who had it had found it worth while then to get sealed. Under the present system a person may keep a patent at the Great Seal for that purpose, and I have been informed that several are always waiting at that stage.

(To be continued in our next.)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 16TH OF AUGUST, 1849.

JOHN GIBLETT, of Trowbridge, Wilts., gentleman. *For improvements in the manufacture of woollen cloth.* Patent dated February 10, 1849.

The object of this invention is to remove grease and other impurities from woollen cloth during the process of washing, and previous to the operations of dressing and milling. This the patentee effects by combining heating apparatus with the washing machinery; and he prefers for this purpose the employment of a coil of steam pipe, submerged in the washing liquid, by which means the liquid acquires and retains a "dry" heat at a temperature of about 80° Fahrenheit.

The patentee states that he does not claim

either the washing apparatus or the heating machinery separately, but he

Claims the combination of heating apparatus (a coil of steam pipe or other substitute) with the washing machinery, for the purpose of removing grease and other impurities from woollen cloth previous to the operations of dressing and milling.

EDWARD NEWTON, of Chancery-lane, civil engineer. *For improvements in engines or apparatus principally designed for pumping water.* (Being a communication.) Patent dated February 12, 1849.

The machinery described consists of a steam cylinder, the free or top end of the piston rod of which forms the piston rod of a pump, so that the same piston rod is common to the steam cylinder and to the pump. The passages for the water into and from the pump terminate in a double passage, so that at the end of the stroke the piston just passes one of these passages, by which arrangement the fluid from before the piston finds its way behind the piston, and thus reduces the power required to work the pump for the moment. The pump valves are placed in a cylinder, and are very nearly similar to those of Messrs. Soutter and Hammond's semi-rotary pump described in this Journal, vol. xlv., p. 313. The steam valve is worked by tappets fixed on the piston rod. The valve itself the patentee names the B valve, from its being similar to the common D valve, but with a bridge in it.

Claims.—1. The arrangements for moving at the proper time the valve, so that the expansive force of the steam in the cylinder may be able to complete the stroke.

2. The employment in pumps of valves radiating from a centre.

WILLIAM BREWER, of Malcolm-place, Clapham; and JOHN SMITH, of Southville, South Lambeth, manufacturers. *For certain improvements in the manufacture of paper and card-board, and in producing water marks thereon, and also in apparatus and machinery to be used for such purposes.* Patent dated February 12, 1849.

The improvements set forth by these patentees relate to the means employed for producing the water marks on paper. They emboss the design upon plates of thin metal, which after having the lower portions of the plates (that is the cavities) filed away, are either attached to the hand frames for making paper, or to the dandy rollers of paper machines; these embossed plates occupy the same positions on the frames and dandy rollers as the wire water marks now in use.

Claims.—1. The manufacture of paper and card-board with water marks formed in dies, as above described.

2. The manufacture of water marks, having the whole or a portion of their surface formed in dies, as described.

3. The manufacture of water marks formed in dies with a backing of metal.

4. The employment of wove and laid frames, and wove and laid dandy rollers, in connection with water marks formed in dies.

5. The employment of embossed wove wire water marks produced by embossed rollers.

And 6. The combination of dies and machinery, as described, when employed in machines for making paper.

JERVIS PALMER, of Camberwell, Surrey, merchant. *For improvements in matches, lighters, or similar articles for igniting combustible bodies, in the mode or modes of manufacturing the same, and in machinery applicable therein; also in match and other boxes, and in machinery for manufacturing the same.* Patent dated February 12, 1849.

The claims of this specification will be gathered from the following improvements, which are specially claimed:—

Matches.—Making matches with a slow fire combustible for igniting by friction, and which, when ignited, will easily part with a portion of the ignited combustible, which makes these matches suitable for lighting cigars; the combustible is composed of a mixture of chloride of potass, Venetian red, gum or mucilage, and some other substances. The body of the matches are sometimes made of metal wire, and dipped at both ends. Making the wood for matches by means of grooved rollers.

Match Boxes.—The machinery for making these, consist of a plane or plough for running out V grooves in the wood. A set of revolving V-edged saws or cutters, mounted upon a spindle, for effecting the same end as the plough. A revolving core upon which the boxes are wound in being made up. And a method of fixing the different junctions at the edges of the boxes by means of small wire pins.

CHRISTOPHER NICKELS, of York-road, Lambeth, Surrey. *For improvements in the manufacture of woollen and other fabrics.* Patent dated February 12, 1849.

The first of these improvements consists in the application of bobbin net or twist lace machinery to the weaving of such fabrics as are composed of materials the whole or part of which are capable of being felted, and producing thereby a milled, piled, or fulled cloth. In other words, this part of the invention consists in using a different thread, or mixture of threads, in a loom hitherto used for other purposes.

A second improvement relates to the construction of apparatus for holding the loops of cut-piled fabrics during the operation

of cutting. The loop is held by two hooks, between which the knife passes, and thus comes over the loop in the most favorable position for dividing it.

A third improvement consists in the application of gutta percha threads in the manufacture of such cloths. The gutta percha threads being exposed only at back, when woven, the cloth is submitted to such a degree of heat as shall cause the gutta percha threads to run together.

Claims.—1. The manufacture of milled, piled, or fulled cloth, as described.

2. The means of holding the loops of cut-piled fabrics.

3. The employment of gutta percha thread in such fabrics.

Edward Lord, of Todmorden, Lancaster, machinist. *For certain improvements in machinery or apparatus applicable to the preparation of cotton and other fibrous substances.* Patent dated February 13, 1849.

The first of these improvements is the application of a weighing table, formed of an endless band, to blowing and other machines used in the preparation of cotton. The weight and position of the table or endless bands together with the weight of the cotton upon it, are so adjusted that, by means of ratchets and pauls, the cotton is caused to be fed uniformly into the rollers of the beater.

The second improvement is to effect nearly a similar purpose by means of a pair of gauging rollers, which, when the feed is too great, are raised up, of course, and by acting upon other gearing, stop the too rapid feeding-in of cotton into the machine.

A third improvement is in the arrangement of rollers and gearing for laying the rovings into the cans.

And a fourth is a different arrangement of moveable bottoms to the cans, so that at the commencement these moveable bottoms are near the top of the can, but as the weight increases by the deposition of the rovings, the bottoms sink accordingly.

Claims.—1. The weighing table, or endless band, for regulating the supply of cotton to blowing and other machines for preparing cotton.

2. The gauging rollers for regulating the supply.

3. The rollers for distributing the rovings uniformly in the cans.

4. The moveable bottoms to the cans.

Matthew Townsend, of Leicester, framework knitter, and David Moulden, of the same place, framework knitter. *For improvements in machinery for the manufacture of looped fabrics.* Patent dated February 13, 1849.

The object of this invention is a simplification of the machinery employed in the manufacture of looped fabrics, whereby the workman is expected to be able to drive the machinery at a greater speed than can be done with the machinery now ordinarily employed, and whereby also the cost of construction of such machines will be lessened.

The chief novelty is a needle of a new construction, by the employment of which the patentees state that they dispense with the presser-bar, which (as is well known) depresses the beards of the needles, and allows the loop on the stems of the needles to be pushed off the needles, and to embrace the thread held under the beards, thus forming a new loop. The needle consists of a stem, terminating in a hook, and having a slot cut in it to receive a tongue turning on a pin, which has its bearings in the sides of the slot; this tongue is of such length that when pushed forward it overlaps the hook. The action of the needle is as follows: A thread is brought on to the stem of the needle, the sinker bar descends, and the needle recedes, which brings the thread under the hook at the end of the needle; at the same time, the loop which is under the tongue, pushes the tongue forward, and passes over it and completely off the needle, when it is caught by the thread under the hook, thereby forming a fresh loop. This new loop now advances, pushes back the tongue, and falls on to the stem of the needle under the tongue. The needle is now in the position which it previously occupied. The thread is then again brought on to the needle, the sinker-bar descends, and the thread passes under the hook; the loop passes over the tongue and off the needle, as before, whereby a new loop is formed. Thus, it will be seen, that the tongue plays the part of the depressed beard in ordinary needles; each successive loop driving the tongue backwards and forwards, first, to pass the loop on to the stem; and, second, to pass it off so as to form a course of work.

The other parts of the invention (which it would be impossible to describe clearly without the aid of engravings) consist of certain new arrangements of machinery for the manufacture of

1. Ribbed fabrics.
2. Purled or twined fabrics.
3. Tubular knitted fabrics.
4. Double seamless fabrics, of the description employed for the manufacture of articles known in the trade as "Imperial Cravats."
5. Warp knitted fabrics.

Claims.—1. The improved needle, before described; also a double needle on the same principle, having a hook and tongue at each end; and a double bearded needle with the parts in connection therewith.

2. The peculiar arrangement of machinery

for the manufacture of ribbed fabrics, in which a double set of the improved needle is employed. Also the construction of vertical sliding sinkers and a slur cock for working the same, whether used in combination with this description of knitting machine or otherwise.

3. The arrangement of machinery for manufacturing purled or twined fabrics, with or without the use of the improved double needles.

4. A new arrangement of rotary machinery for manufacturing tubular knitted fabrics; also the construction of a new presser wheel and beard presser.

5. The general arrangement of machinery for manufacturing double seamless fabrics, and particularly a new arrangement of needles, and the peculiar construction of a double elastic thread carrier.

6. The general arrangement of machinery for manufacturing warp-knitted fabrics.

Edward Newton, of Chancery-lane, civil engineer. (A communication.) *For improvements in machinery for hulling and polishing rice and other grain or seeds.* Patent dated Feb. 13, 1849.

The improved machinery consists of a hollow cylinder of perforated metal, within which there is placed a revolving spindle, carrying a set of brushes, which are adjustable so as to leave a wedge-shaped cavity between the surface of the brushes and the cylinder. As the brushes revolve, the more distant edge of the brush goes first, which causes the grains of rice in the cylinder to be rubbed over the surface of each other; to the same revolving spindle carrying the brushes there are attached two sets of plates, which are placed somewhat diagonally upon the shaft, so as to cause the grain to be impelled along the cylinder: the shaft also carries two blocks of caoutchouc which are intended to act as rubbers to hull the rice, and also a piece of lambs' skin, with the wool exposed, so as to rub over the surface of the rice and polish it.

Claims.—1. The arranging the brushes upon the spindle at an angle, as above described.

2. The feeders, as being placed at an angle upon the shaft for impelling the rice, and the feeders being adjustable so as to cause the grain to travel slower or quicker.

3. The caoutchouc rubbers, as employed in connection with the brushes, or in a machine by themselves for hulling rice.

4. The lambs'-wool polishers.

5. The combination of the adjustable brushes being attached to the shaft by hinges and adjusting screws.

Richard Ford Sturges, of Birmingham, Brittannia-ware manufacturer. *For improvements in the manufacture of candlesticks and lamp pillars.* Patent dated February 14, 1849.

The improvements described by the patentee relate to the manner of casting candlesticks of a character and pattern which cannot be finished in a lathe, and consist in making hollow metal moulds, into which the molten metal to form the candlesticks is poured. He prefers that the moulds should be placed upon a revolving table during the process of casting.

Claim.—The casting of such candlesticks and candle-lamp pillars as cannot be finished upon the lathes in metal moulds.

William Chambers Day, of Birmingham, iron founder and weighing-machine manufacturer. *For improvements in machinery for weighing.* Patent dated February 14, 1849.

The improvements in weighing machinery exemplified and described by this specification, consist in the construction of an upright weighing machine. The scale or table rests and acts upon a lever placed below it; the lever is again connected by a link, or rod, going up the back of the machine to a steel yard, placed at a convenient height, for reading off the results. The scale or table is retained on its knife-edged centres upon the lever placed below it, by means of an upright rod, which is connected by a link to the upper part of the machine. There are two wheels placed on the back of the framework, so that by tilting over the frame, the weight comes upon the wheels, and may in that state be easily removed.

Claims.—1. The lever placed below the scale or table, and as connected with the steel yard.

2. The link at the top of the upright rod.

3. The wheels as applied to weighing machines.

Achille Chandois, of Faubourg du Temple, Paris, manufacturing chemist. *For improvements in extracting and preparing the colouring matter from orchil.* Patent dated February 14, 1849.

The present patentee obtains an extract of the colouring matter from orchil by means of hot water, and then treats the solution with ammonia, in the usual way in which lichens have been heretofore treated for producing the colouring matter.

Claim.—The treating of the solution in the manner above described for obtaining colouring matter.

Hugh Lee Pattinson, of Washington House, Gateshead, Durham, chemical manufacturer. *For improvements in manufacturing a certain compound or certain compounds of lead, and the application of a*

certain compound or certain compounds of lead to various useful purposes. Patent dated February 14, 1849.

The first of these improved compounds is an oxychloride of lead, which is a fine white powder, and applicable to a great many purposes for which white lead is now used. It is formed by a solution of chloride of lead, with a solution of chloride of lead, with a solution of lime or soda, or other alkali (lime being preferred on account of its cheapness.) A saturated solution of the lime is thrown into a solution of the chloride of lead, the white powder of the oxychloride is thrown down, and afterwards separated for use.

Claim.—The combination of the chloride of lead with alkalies, to form a pigment, as described.

Specifications Due, but not Enrolled.

George Edmond Donisthorpe, of Leeds, manufacturer, and James Milnes, of Bradford, both of York. *For improvements in apparatus used for stopping steam engines and other first movers.* Patent dated February 12, 1849.

William Harris, of Battersea, Surrey, shoemaker. *For a new or improved mode of preparing leather.* Patent dated February 12, 1849.

COPYRIGHT OF DESIGNS.

Guildhall, London, August 13, 1849.

BENESH *v.* BROOKS.

Mr. Payne, instructed by Mr. Gregory, appeared for the complainant; and Mr. Clarkson, instructed by Messrs. Robertson and Co., Registration Agents, 166, Fleet-street, for the respondent.

The information alleged that the respondent on the 20th day of June last past, did unlawfully publish, sell, and expose for sale, goffered and rouched trimming, to which a fradulent imitation of a certain new and original design of the complainant for ornamenting] articles, comprised in Class 13 of a certain Act of Parliament, had been and was applied, after having had notice in writing from the agent for the said complainant, that due consent of the said complainant had not been given to such application of his said design, he the said complainant being then and there the proprietor of the said design, contrary to the form of statute in such case made and provided, &c.

Mr. Payne said that Mr. Benesh had just right to complain in this case against a rival manufacturer for pirating his designs. It was by the encouragement given to genius that we became a great commercial nation, and the Legislature had thought fit to pass an Act to secure to the ingenious, for a limited term at least, all the profits of their ingenuity. The article which he would bring under the notice of the magistrate was a double row of twilled lace, with which ladies ornament their bonnets. The making of this lace with two rows, of an equal width, had been practised for some years, but Mr. Benesh improved upon this, by making one of the rows narrower than the other, or the putting an inner row of less width. The great demand for the article showed that this was a decided improvement.

Mr. Alderman Salomons said it would rather be the task of a lady than a magistrate to decide which was the more tasteful of the two designs.

After some further exposition of the law upon the subject, Mr. Payne referred to the opinion given by Mr. Justice Coltman in the case "Leader *v.* Purday," which was a complaint of new words having been put to some old music, on which the judge insisted on the principle that, if anybody improved upon an old machine, the maker of the old machine was not deprived of his right to make his machines in the customary manner, but that he must not adopt the improvement.

Mr. Alderman Salomons, taking up the ticket of the registration, remarked that it seemed to be very vague. It did not point out for what part of the thing registered the claim of novelty was made, and what was admitted to be old.

Mr. Clarkson said the worthy alderman had just hit into the middle of an objection he was about to make, that the specification filed was insufficient to secure any right whatever. There was a simple pattern of the article attached to a piece of paper, with the words "This is the article for the invention of which a registration is claimed," and thereupon the registrar had affixed a number, and that completed the specification.

Alderman Salomons said it looked as if the registrar would take anything to be new and original, without any proof of the fact, leaving a court of equity or a magistrate to settle whether the thing registered was new or not.

Mr. Clarkson said that was precisely the case. But if the party offering the specification gave in it no description of his invention, the registrar could only give him, as in this case, a certificate of registration. To save time he would admit the registration and the sale of the article, so as to reduce the question as to the originality of the design.

Mr. Payne thought it advisable to offer some evidence of the sale. He called,—

Mr. *Robert Mee*, who said that he was

buyer to Messrs. Groucock and Co., of Bow Churchyard. He purchased from Mr. Brooks, on the 20th of July, six boxes of goffered and rouched trimming, and afterwards sold two of them.

Cross-examined: The novelty of the lace is, that the inner portion of the quilting is narrower than the outer, the former being twenty threads, while the latter on each side was thirty threads. He had not seen any of that make previously, and, therefore, could come to no other conclusion than that it was a novelty.

ALDERMAN SALOMONS: How do you come to the conclusion that it is a novelty? —Witness: Because it creates a sale.

Mr. CLARKSON: Suppose an old lady was to wear out one edge of a lace border, and were to cut off four or five threads all the way round, would it not resemble the border now claimed as a novelty?—Witness: I cannot answer that question.

Mr. CLARKSON: Then I hope Messrs. Groucock and Co. are not present to hear you say so.

Mr. *Charles Nunn*, of Aldersgate-street, proved purchasing the two boxes of lace, on the 21st of July, at Messrs. Groucock's and Co.

Mr. PAYNE said that was his case.

The Chief Clerk said that it had not been shown that the parties had resided as well as carried on business in the City.

Mr. PAYNE suggested that the magistrate should, in order that justice might not be defeated, call a witness who could speak upon the point. He remembered that in a trial for burglary, he objected that the prosecution was closed and the parish had not been proved. The judge, however, would not allow the prisoner to be acquitted on that account, but recalled a witness and proved the fact.

Mr. CLARKSON, on behalf of the defendant, admitted that his client did reside on the premises.

Mr. CLARKSON then addressed the Court at great length in reply to the case, contending that he was entitled to a dismissal—first, because the certificate was incomplete, and therefore conferred no right on the complainant; next, that the notice given to the defendant was insufficient, for, instead of being a notice to a seller that consent had not been theretofore given to the maker to imitate his registered design, it was merely a notice to the seller not to sell in future without the complainant's consent. He objected, in the third place, that the design so registered was not new at the time of registration, but had been previously employed by other makers; upon that ground, therefore, the certificate of registration conferred no benefit. With respect to his first objection, as to the want of a sufficient description, he would ask how any one could understand from that certificate what the other had registered, or in what the novelty claimed consisted? Mr. Clarkson read two letters which his clients had received, and compared them with the requirements of the statute, to show that neither notice amounted to anything in law. As to the third point, he should show that the article had been made for several years.

Mr. PAYNE objected to the admission of evidence as to the non-originality of design, as the registrar's certificate was to be conclusive on that point.

Mr. CLARKSON said, it had always been held that the words of the 16th sec. of the Act let in the right of examining witnesses to show there was no novelty of design. It said, "A certificate was to be taken as conclusive of the originality of design, *in the absence of evidence to the contrary*." That evidence therefore might be given.

Mr. ALDERMAN SALOMONS thought so too, and the case proceeded.

Elizabeth Erswell said she had been forewoman to the defendant for the last sixteen years, and she was well acquainted with the rouche article for the last nine or ten years. It consisted of a piece of lace with a thread drawn through it, so as to bring it into the shape of what was called quilling. She had made it of all sorts and sizes, in different colours, and different widths, and in the same manner as those produced, the inner lace being of less width than the outer.

The witness was cross-examined at some length by Mr. Payne, but he did not elicit anything in favour of his client, for Mrs. Erswell said that she had been in the habit of making these rouche articles for the last four or five years, including the one which was now set up as a novelty.

Mr. *Henry Simmons*, milliner, of High-street, Islington, said: I have dealt in rouche these ten years, and I do not consider that rouche of different widths is a novelty. I never saw this description of rouche until within a week. I don't consider it a novelty in putting two different widths of lace together. I can't call it a novelty, although I have not seen it before.

Mr. *William Bayne* said he was buyer to Messrs. Fisher and Co., Watling-street, and from his experience he considered that putting two widths together was new, but putting the one on the top of the other was not.

Cross-examined: He never saw the pattern in question until lately.

George Brooks, of Walworth, wholesale dealer, said he was brother to the defendant, and did not consider there was any novelty in the design, as he had been in the habit of

making the two different widths for the last four years in all colours.

Mary Hughes deposed that before the 14th of June she had seen a bonnet with trimmings of the same description as that now in question. This was on the 29th of May. She did not make any particular examination, but thought that the inner lace was about twenty threads wide, and the outer the usual length of thirty. She had been many years in the rouche line, and seen a great deal of it of different sizes, but only lately.

In reply to the defence,

Mr. *Mee* was recalled, and said that Mr. Brooks had told him that he had made it years ago, and that Mr. Benesh ought not to have registered it.

By Alderman Salomons: I call this a novelty, because one portion of it is narrower than the other.

Mr. *Hesketh Hughes*, of Bunhill-row, lace-manufacturer, also said he considered that the rouche lace, made up as it was, was a novelty.

This being the whole case,

Mr. Alderman Salomons retired for a short time to consult with the Chief Clerk, and on his return into Court said this was a case of that description where great responsibility was thrown on one magistrate to decide upon a case, and where the Act of Parliament itself was not very clear. He could not help thinking there ought to have been something in the certificate describing the article, so as to guide him as to what was new, and whether that had been infringed upon; for it left him to go through a labyrinth of evidence to ascertain what the design was, and what was not claimed as new. Besides the insufficiency of the ticket, he was of opinion that the balance of evidence was against the applicant as to his having originated this mode of making up the lace, and therefore he must dismiss the information.

Mr. Clarkson intimated that if ever Mr. Benesh brought him there again he should press for costs.

NOTES AND NOTICES.

The *Moniteur* announces that the President of the Republic has authorized an English gentleman, Mr. Jacob Brett, to establish, on the coast of France, between Calais and Boulogne, a sub-marine electric telegraph, which is to cross the channel, and communicate with the English coast at Dover. The treaty concluded with Mr. Brett guarantees certain advantages to the French Government, and leaves all the expense to the contractor, to whom it secures a privilege of ten years should the experiment succeed. The works are to be terminated on the 1st of September, 1850, at the latest.—*Times.*

Failure of a Cast-iron Girder Bridge.—The extension of the South-Western Railway from the present terminus at Datchet to the Town of Windsor, was expected to have been opened in the course of a very few days. In the course of Sunday last, however, an unfortunate occurrence took place, which may probably delay the opening of the line for some considerable period. It appears that the girders of one of the arches of the bridge which crosses the Thames near Eton College snapped; rendering that arch, for the present, most insecure. The masonry and brickwork of the piers are built on caissons of cast iron, driven into the bed of the river, by means of Dr. Pott's patent process; the superstructure above the masonry being of cast iron. One of the piers, in consequence of the great weight, appears to have sunk several inches, thus causing the snapping of the girder in question. We are informed that considerable fears are entertained that the caissons will sink still further, it being supposed that they are now chiefly resting on a soft bed of clay. Should this turn out to be the case, the bridge must be reconstructed, or at least a great portion of it. It is much to be regretted, after the experience of the brittle nature of cast iron girders of the bridge over the Dee, on the Chester and Shrewsbury line, that railway companies do not incur the extra expense of constructing their bridges of wrought iron, and thus, as far as possible, insure the safety of the public.—*Times.* [Or of cast iron strengthened by wrought iron, according to Mr. Gardner's patent.—Ed. M. M.]

Screw Steaming.—Messrs. Maudslay, Sons, and Field made an experimental trial on Monday last of a new steam vessel called the *Bosphorus*, belonging to the General Screw Steam Shipping Company. The vessel left Blackwall about 1 o'clock, and made five runs in Long Reach, the mean rate of which showed a speed of 9,679 knots per hour, which is considered the best result ever obtained by a screw vessel of the same horse power per ton. The *Bosphorus* was much admired for her symmetry, and the engines worked with the greatest accuracy, without noise; the vibration could scarcely be felt at any part of the ship. The following particulars will be satisfactory to those interested in the propulsion of ships by the screw;—The *Bosphorus* is 175 feet between the perpendiculars, breadth 25 feet, depth 15 feet, engines 80 horses-power, direct acting; draught of water on trial, forward, 6 feet 8 inches, aft, 9 feet 6 inches; mean draught of water, 8 feet 1 inch; screw 14 inches above the water; diameter of screw, 10 feet 6 inches; pitch, 18 feet 6 inches; mean revolutions, 62·2 per minute; speed of screw, 11·348 knots; slip, 14·7 per cent.; length of engine-room, 30 feet, including stowage for 150 tons of coals.—*Times.*

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Ruthven, of Edinburgh, civil engineer, for improvements in propelling and navigating ships, vessels, or boats by steam or other powers. (Being a communication.) August 10; six months.

Arthur Dunn, of Worcester, soap maker, for improvements in making soap. Aug. 16; six months

Frederick William Bochner, of Paris, France, civil engineer, for certain improvements in machinery or apparatus for letter-press printing. August 16; six months.

Richard Archibald Brooman, of Fleet-street, London, patent agent, for improvements in machinery, apparatus, and processes for extracting, depurating, forming, drying, and evaporating substances. (Being a communication.) August 16; six months.

Jonathan Blake, of Mount Pleasant, Eaton, Norwich, surgeon, for certain improvements in lamps. August 16; six months.

James Young, of Manchester, manufacturing chemist, for improvements in the treatment of certain ores and other matters containing metals, and in obtaining products therefrom. August 16; six months.

Louis Lemaitre, late of Paris, but now of the Hotel de l'Univers, Blackfriars, engineer, for improvements in the manufacture of ferules for fixing the tubes of locomotive and other boilers. August 16; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Aug. 10	1988	Charles Pinnell	Trellick-terrace, Vauxhall	Letter-box.
11	1989	Benjamin Frederick Atkinson	Strand	Truss.
,,	1990	J. Sparkes Hall	Regent-street	Elastic gaiter.
,,	1991	John James	Bishopsgate-street, City	Water trap.
14	1992	William Whitehurst & Co.	Oxford-street	Graduated carriage spring.
,,	1993	Jennens Bettridge and Sons	London and Birmingham	Writing folio desk,
,,	1994	Thomas Green	Birmingham	A set of metallic fittings and variators for lasts and boot-trees, and shoe-cleaners.
16	1995	Jean Francois Isidore Caplin	Berner-street	Corsets.
,,	1996	Bernhard Samuelson	Banbury, Oxford	Parts of apparatus for cutting turnips and other roots.
,,	1997	Richard Reed Rapson	Penryn	Apparatus for dressing flour, &c.

NOTICES TO CORRESPONDENTS.

The Supplement to the last Volume, containing Title and Table of Contents, is now ready, and may be had of the Publisher, Gratis.

Errata.—In the article on the "Invention of the Dredging Machine," p. 126, col. 2, line 12 from the bottom, *for* "1806," *read* "1800."

Abstract of Pinchbeck's Patent, p. 140, col. 2, line 7 from the top, *for* "getting *in*," *read* "getting *rid*."

CONTENTS OF THIS NUMBER.

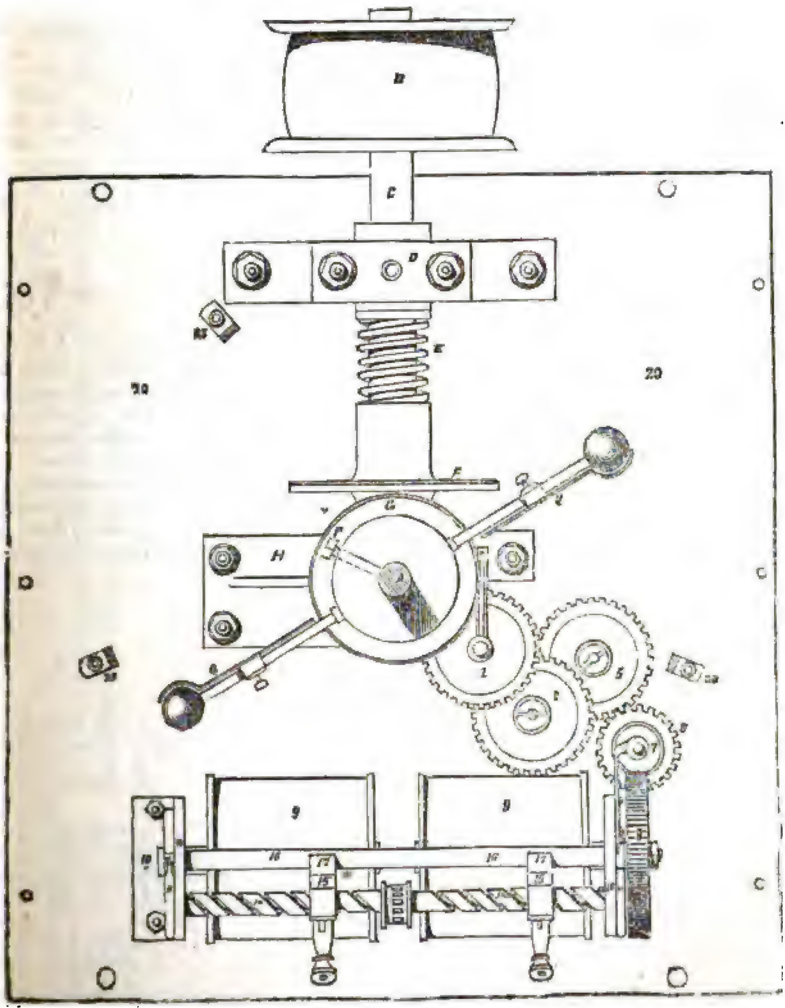
LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1359.] SATURDAY, AUGUST 25, 1849. [Price 3d., Stamped, 4d.
Edited by J. C. Robertson, 166, Fleet-street.

DIXON'S PATENT VELOCIMETER.

Fig. 1.



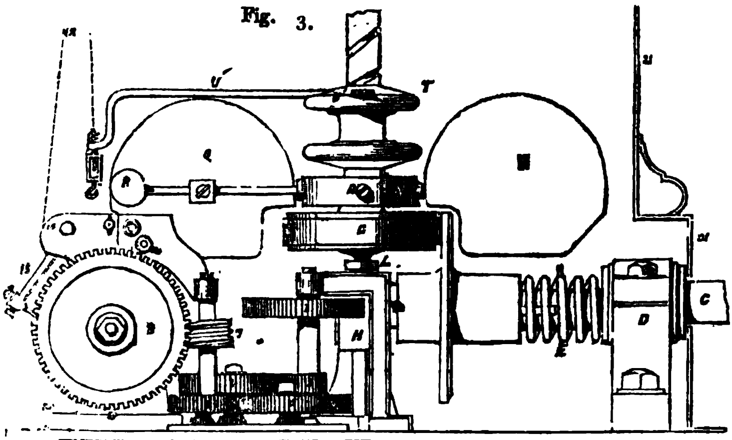
We had recently the pleasure of inspecting a very ingenious instrument, invented by Mr. John Dixon, C. E., of Amsterdam, for the useful purpose of indicating and registering the speed of railway engines and carriages.* It is now more than three years since it was patented in this country (in the name of Mr. W. E. Newton, on behalf of Mr. Dixon, 11th February, 1846); but it has not yet had the good fortune to obtain favour in the sight of any of our railway companies, or even to be noticed in any of our scientific journals. We now, therefore, willingly devote a few of our pages to bringing its merits before the English public.

Fig. 1 of the accompanying engravings is a birds-eye view of the apparatus; fig. 2, a side elevation; and fig. 3, an end elevation. The apparatus is shut up in a box, but in each of these figures, those parts of the box which would obstruct the view of the interior mechanism are supposed to be removed. The other figures, 4, 5, 6, 7, and 8, are each illustrative of some particular portion of the apparatus.

C is a main shaft, supported by bearings, D and H, and is driven by any of the carrying-wheel shafts of the locomotive, through the medium of a belt embracing the pulley, B (see fig. 2); on this shaft is placed the faced pulley, F, which partakes of its motion; but being fitted on a square feather fixed on the shaft, it can slide backwards and forwards (see K, fig. 3.) A spiral spring, E, fixed on the shaft, and resting against the bearing, D, presses the pulley, F, against the side of the pulley, G, mounted on the upright irregular screw, A; which last pulley is grooved and filled with cotton, rope, or leather, so as to present an adhesive suface to the face of F. The irregular screw, A, works at bottom in a step, L, fixed on the top of the support belonging to the shaft, and marked H. At the upper extremity this screw, A, works in a support, M. The mode in which this screw is constructed, is represented in fig. 8. On the line A K, take A ·L, equal to the circumference of the spindle upon which the screw is to be cut; at L draw a perpendicular, and at A, construct an angle of a given quantity, say, for instance, of 7 degrees. The triangle, A, L, C, thus formed, being a right-angled plane triangle, the hypothenuse, A C, will describe on the surface of a cylinder the circumference of which is A L, a spiral thread.

At C draw C C^1 parallel to A K, and equal to A L, and construct there an angle double in quantity to the angle at A, or 14 degrees. The hypothenuse C D would describe on the surface of the spindle a second spiral thread. In like manner go on constructing at D, E, F, G, H, I, angles progressing constantly 7 degrees each; then by tracing a curve that will pass through all

Fig. 3.

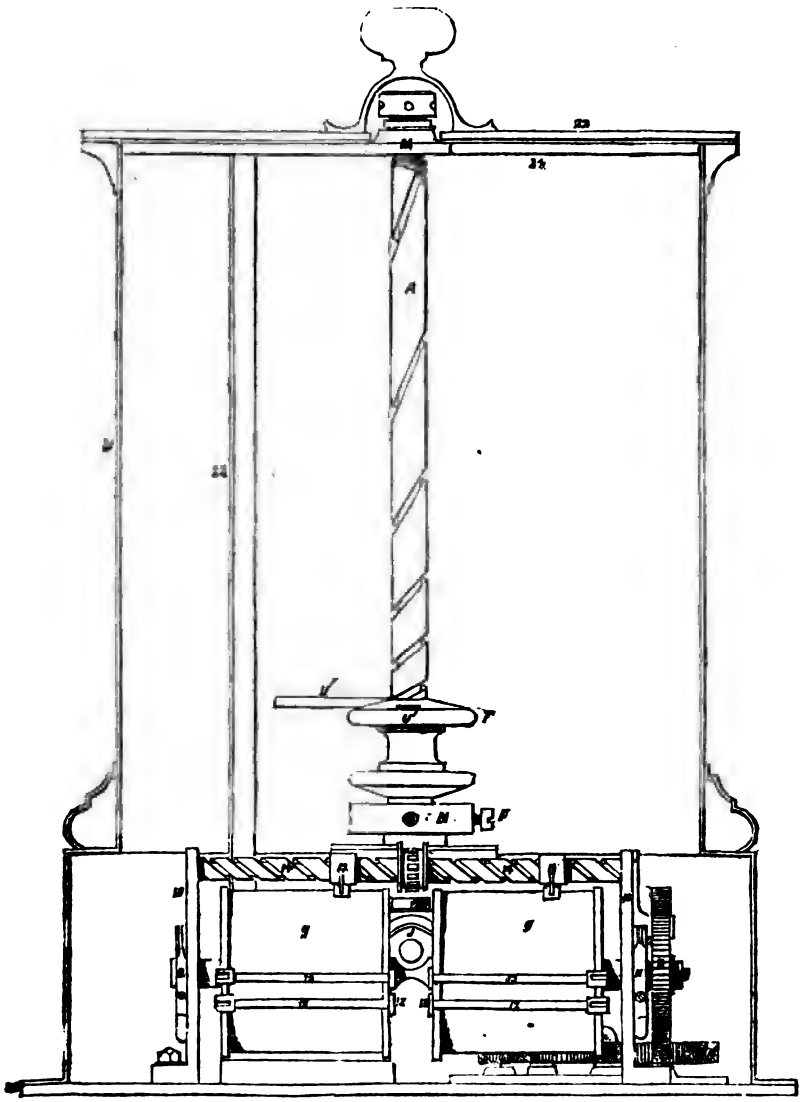


these different points A, C, D, E, F, G, H, I, B, and winding this curve round

* At the Works of Messrs. Crosley, Son, and Galsworthy, Emerson-street, Southwark, where it may be also seen by other parties interested.

the surface of the spindle of which K, B indicates the height, it will describe one continuous spiral thread gradually increasing in the pitch. The instrument is so made, that when the pin or stud of the piece Q is in the first part of the thread of the screw, the roller, Y, shall be exactly under the projecting part of the first treadle and acting against the same. By calling this a speed of 10

Fig. 2.



miles an hour, for instance, the second treadle 20 miles an hour, the third 30, and so on progressing by 10, they will correspond to the angles of each thread of the screw, the first being 7 degrees, the second 14 degrees, the third 21 degrees, and so forth, and presenting thus to the piece Q, a resistance in proportion to its speed, or tendency to rise.

A circular disc, N, is bored to fit

exactly the diameter of the irregular screw, A, so that it can slide freely up and down; moreover, a steel pivot, P, is screwed in the side of it, which pivot fits

Fig. 4.

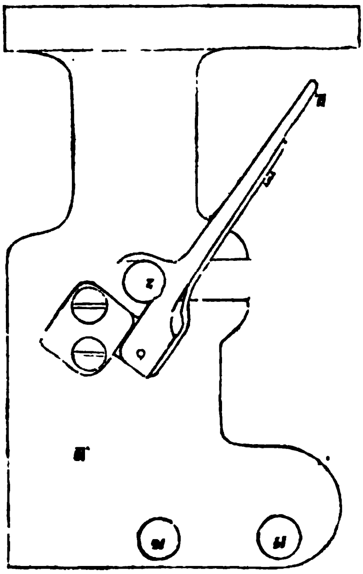


Fig. 6.

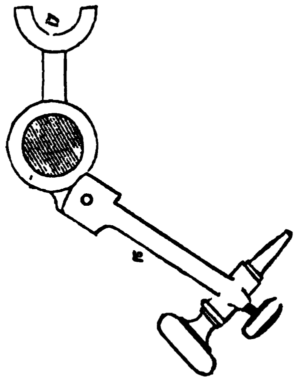


Fig. 7.

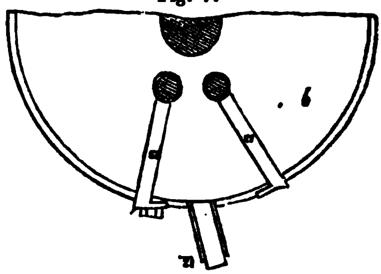
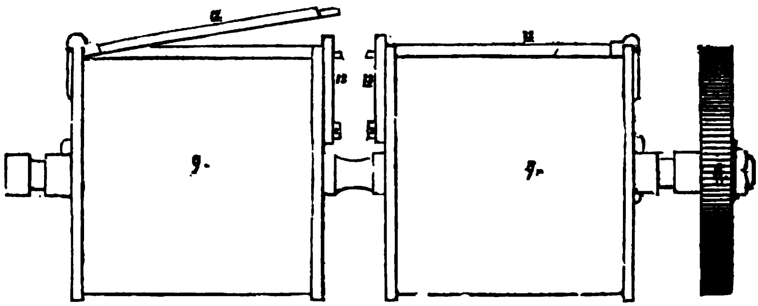


Fig. 5.



into the thread of the screw. Two little vanes, Q, which can be set at any desired angle by the small set of screws, S, are also attached on each side of the piece, N. It follows that when the screw, A, is made to revolve, as in the figure, from right to left, it carries along with it the vanes, Q: but as the speed augments, the resistance of the air against the vanes augmenting also, they raise up the spindle proportionately to the angle of resistance. In reducing the speed, they of course drop by the gravity alone of the piece, N. This screw, on the different angles of its thread, can be constructed so as to correspond with any desired speed, and in any proportion.

On the top of the piece, N, there rests another piece, T, bored also to fit exactly the outside diameter of the shaft, A, but without pivot. It has two arms, U and U′; the one marked U extends out of the side of the box, and is furnished with an index, which shows the different

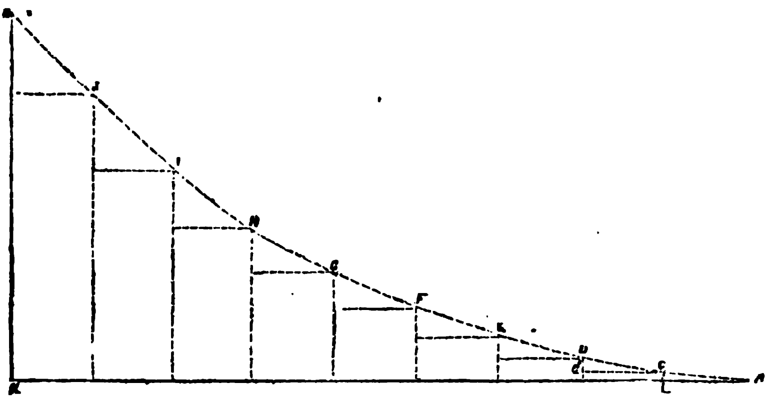
speeds which the instrument is worked at, by numbers fixed on the outside of the box.

So far as the instrument has been described, it serves merely to indicate to the engine-driver, guard, or others, the speed the train is running at; but to enable it to *register* also, the following additional arrangements are made:

On the end of the main-shaft, C, there is a worm, which communicates motion to a little drum, *g*, by the series of wheels, 1, 2, 3, 4, 5, 6, 7, 8, so that for every 100 revolutions of the shaft, C, the drum is made to revolve any required quantity by changing or modifying the proportion of the wheels. This drum, which is represented in the figures as carrying two cards, can be made larger or less; it works in the two bearings, 10; a profile of which is given separately on an enlarged scale in fig. 4. The drum is put in its place, or taken out, by lifting up the catch, 11, and letting it drop down again; locking thereby the drum in its bearings in such a manner as to prevent its getting out.

A roll of prepared paper, or any other suitable material, is fastened round the drum by the little levers, 12, 12, and the catches, 13, 13, 13, 13. The paper is ruled in one direction, or lengthways, indicating the speed in miles per hour, and horizontally showing the miles run over. Between the two supports, 10, 10, there is fixed, in the same plane as the drum, a screw, 14, on which are made to travel two pencils or metallic tracers, 15, 15; the construction of which is shown at fig. 6, and easily understood. Behind the screw, 14, is fixed a sliding-bar, 16, against which moves the part, 17, of the pencil, for the purpose of keeping the machine more steady.

Fig. 8.



In the middle part of the screw, 14, is fixed a small wheel, round which is passed a chain, 18 (fig. 4), which, after passing round the little pulley fixed at the top of the box, is fixed with tightening screws to the end of the arm, U¹, of the piece, T. This piece, T, by the rising or descending motion imparted to it by the disc, N, causes the pencils or tracers to move backwards or forwards, and to indicate thereby the changes of speed of the instrument.

No. 20, in all the figures, represents the base plate, upon which all the parts are constructed.

21, is the outward casing.

22, the cover.

23, 23, 23, are uprights supporting the cross piece, 24, by which the upright screw, A, is supported, so that the whole box or casing can be taken off, if necessary.

Mr. Dixon points out in his specification how his instrument may, with some inconsiderable modifications, be made to *regulate*, as well as indicate and register the speed of locomotive engines; and also to actuate a governor or register in conjunction with an indicator, without using the registering apparatus.

The master feature of the machine is the progressive power, and is thus specially claimed:—

"Any progressive screw or spiral cam placed vertically for controlling the ascent or descent of a rotary flyer, by means of which the speed of carriages or other working machinery may be ascertained, registered, and regulated through the agency of other mechanism."

We gave a very full account of this invention on the enrolment of the ingenious inventor's specification (see vol. xliii., p. 273.) Our readers may remember that Mr. Gordon, instead of propelling vessels by means of steam engines, acting on the water through the medium of paddle-wheels or screws, proposes to propel them by causing the products of the combustion of coal, as they rush at a high velocity, and in an intensely hot state from the furnace, to impinge directly against the outside water in a backward direction, and thereby to obtain the reactive force necessary to move the vessel forwards. The advantages anticipated from this novel mode of propulsion were these:—That it would be attended with less expense than any motive agent hitherto made use of for purposes of navigation; that it would impart a velocity unattainable by means of paddle wheels or screws; that it would occupy, with its fuel, less than one-half the space now engrossed by the steam engine machinery of a vessel, and might be all kept below the water line; that it could be set to work more speedily than a steam engine, and when at work would neither belch forth smoke nor shower down soot and brine upon deck, &c., &c. We now understand that the Lords of the Admiralty think so well of Mr. Gordon's plan, that they have offered him the use of one of Her Majesty's fastest screw steamers for the purpose of a trial on a large scale, and that a scheme is on foot for raising by subscription a sum of money sufficient to defray the expenses of the trial.* We trust that our friends of shipping interest will come forth liberally on the occasion, and we cannot better recommend the project to their attention than by laying before them the following letter, which Mr. John Seaward, the eminent engine maker, has, with a rare liberality, addressed to Mr. Gordon on the subject:—

Mr. Seaward to Mr. Gordon.

"Canal Iron-works, Limehouse, March 5, 1849.

"Dear Sir,—After much consideration of your plan of propelling by means of the rarefaction of air or other permanently elastic fluids, I regret to say that I cannot yet form any decided opinion as to its *ultimate* success, although I admit there is great probability. Were it a simple mechanical question there would be no great difficulty in coming to a conclusion; but the inquiry is of a very complex nature, and involves the consideration of many elements, upon which I believe there is very little of well-established practical knowledge to be met with.

"If I understand aright, you assume from data, furnished by eminent writers, that the combustion of 1 lb. of coals will import to 74 lbs. of air (*i. e.* 980 cubic feet, at the common pressure of the atmosphere), sufficient heat to raise the temperature 480°; and that thereby the volume of air will be increased twofold. Now, if this can be relied upon as an established well-authenticated fact, *I can have no hesitation in stating, as my opinion, that by proper appliances an available motive power of great force can be obtained therefrom.* Whether the motive power so obtained will be more or less economical than that obtained by the medium of steam, and whether it will be found as manageable as the latter, are questions which at present I confess my inability to answer. We know that 1 lb. of coals will convert the one-eighth part of a cubic foot of water (*i. e.* 8 lbs.) into steam, which, under the ordinary pressure of the atmosphere, will expand to a volume of about 220 cubic feet: but the expansion of air by the combustion of the same quantity of fuel is shown in the above statement to be 980—that is, four time that of water. Now if we are to assume that the motive power would be in proportion to the positive expansion of the two bodies (*i. e.* of the air and of the water), it is clear that there would *be a wonderful advantage in favour of the first* (*i. e.* air).

* "The subscribers are to have an opportunity afterwards of deciding how far and in what manner the system shall be carried out by a joint stock company." Each subscriber is to have the option of demanding an allotment of a certain number of shares in such company proportional to the money subscribed; and a "subscriber not determining to take shares is to be exempt from any further advance, and not to be, directly or indirectly, subject to any responsibility whatever beyond his original contribution." Messrs. Gordon and Son, of 57, Old Broad-street, are the solicitors to the project.

"But it should be remembered that the rate of expansion in the two bodies is a very different thing from the above; in the water it is 1700 to 1, while that of air is only 2 to 1; a consideration of this fact and of some others, leads me to be sceptical as to there being any positive advantage in the rarefaction of air for a motive power as regards the cost of the fuel.

"But I will imagine the cost of the fuel for producing the same amount of motive power by the rarefaction of air is twice, or even thrice, that obtained by means of steam; still, *considering the very great convenience and simplicity that would result in propelling from the mode of operating proposed by you*, supposing it can be successfully carried out in some form analogous to the plan shown in your drawings; and I conceive the plan will, in many situations, even then be found a valuable substitute for steam.

"As regards the mode of carrying out this new way of propulsion, the *modus operandi*; I conceive the plan proposed by you, or some modification thereof, very likely to answer the purpose, but in a matter which is so very obscure, so conjectural, and of which so little positive is known, it is impossible to say what change of form may be required in the apparatus. But in order to carry out a good series of trials and experiments we must make up our minds that many changes and modifications will undoubtedly be required.

"Offering the above few remarks for your consideration,

"I am, dear Sir, yours obediently,
(Signed) "JOHN SEAWARD."

"To Alexander Gordon, Esq.

Mr. Gordon has published some other opinions which are of a still more decided character.

Dr. Arnott, in his "Elements of Physics," observes that, "Had the truth been generally known, which very recent investigations have proved, that any given quantity of heat, when used to dilate air, produces about four times the quantity of expansive power that it does when used to form steam, the attempts to bring such an application of heat under control would probably have been much more numerous, and possibly by this time successful. * * * * Its advantages over the steam engine would be very considerable; it would occupy much less room, would be very light, and have its peculiar fitness for purposes of propelling ships."

Captain Sir Thomas Hastings, R.N., whose name is so intimately associated with gunnery and rocket practice, has, unasked, written to Mr. Gordon, saying, he "cannot refrain from expressing his hope that 'Mr. Gordon' will press into a trial principles which promise so beneficial a result."

Professor Baden Powell, of Oxford, expressed his "admiration at the simplicity of the principle."

Mr. Maugham says, "There cannot be the least doubt, theoretically speaking, of the advantages that will be gained by using the heated products of combustion in the manner described, instead of employing steam in the ordinary way."

Dr. Ure considers Mr. Gordon "can make a powerful, durable, and economical engine, a successful rival to, if not a substitute for, the steam machinery of steam-boats."

Mr. Gordon adds, from himself:

"The experiment proposed to be made will also show not only whether the chimney and its evils can be dispensed with, but whether the heat (500°) now lost at the top of the present steam-boat chimneys can be rendered useful below water as an impelling power, on the principle of the rocket, either alone, or in addition to the power which may be exerted at the same time by the present steam engines by means of a screw or paddles; and Mr. Seaward's opinion confirms the same.

"Many persons have tried to bring the theoretical advantages of heated air into practical operation, to obviate the greater expenditure of fuel when used to raise steam. And all such attempts have failed for practical purposes, because they employed some modification or imitation of the steam engine. But Mr. Gordon, instead of imitating a steam engine, has used close furnaces, and has produced the effect of a rocket, and the following will show with what success:

"Into a boat 26 feet long and 4½ broad, he fitted a close furnace or retort, and a common small forge bellows. The close furnace being opened at top and at bottom, an intense fire was got up; the bonnets at top and at bottom were then luted and fitted

tight. Each stroke of the lower portion of the bellows passed air through the close fire, and the hot products of combustion rushed out against the water.

"The boat, when tried with this apparatus, weighed in all 4375 lbs.; in other words, that weight of water was displaced by her flotation.

"Each stroke of the portable forge bellows sent cold air into the close furnace. The appropriation of oxygen to support combustion was *immediate*; and the heating of all the aëriform body which passed off under water was *equally so*. The products of combustion, almost altogether aëriform, but also occasionally mixed with smoke, dust, and ashes, rushed out under and against the water at a very high velocity (at a temperature of 800° or 900°), and impelled the boat in her course; the fire and one man blowing did the work of two men rowing."

ON THE CAUSES OF THE DEFECTS IN OUR NAVAL ARCHITECTURE.

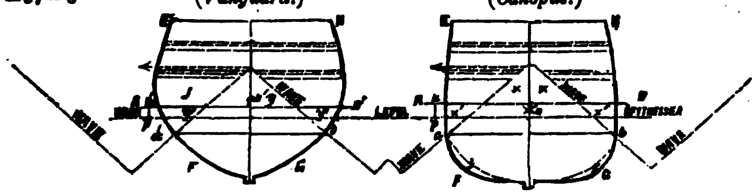
There has been a too general idea that the motions of ships, in an agitated sea, were merely oscillations round a centre fixed vertically, whereas their centres under such circumstances are in continual motion.

The phenomena called waves arise from a vertical motion in the particles which constitute them; they themselves *only*, not the water, constituting them, having a horizontal motion. This agitation, or motion, commences at, and is greatest at, the surface; and is least with the greatest depth below it—the consequence of which is, that in proportion as a vessel's displacement is great at or near the surface, and that far from the surface small, she will be subject to greater motion; in other words, in proportion as her area of load-water line is large in comparison to her total displacement, when compared with that of other vessels, in that proportion will she be subject to more rapid and more extensive motions; in fact, she will be more sensitive to every agitation of the sea.

That this is so will appear evident from the following figures and reasoning:

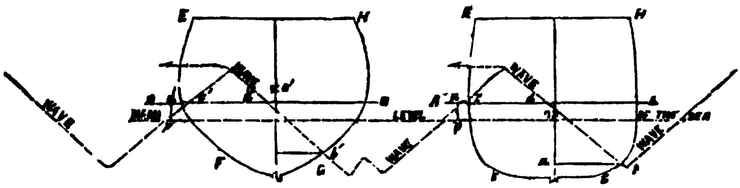
$a'b' = 46$
A'B $= 57-6$

Fig. 2. (*Vanguard.*) Fig. 1. (*Canopus.*)



$$\left.\begin{array}{l}A'B' = 57\cdot5^3 = 190150 \\ a'b' = 46^3 \ \ = \ \ 97263\end{array}\right\} \text{Stability will vary as} \left\{\begin{array}{l}AB = 52^3 = 140602 \\ ab = 52^3 = 140602\end{array}\right.$$

Fig. 3. (*Vanguard.*) Fig. 4. (*Canopus.*)



	ft.	in.
$c'd'$ =	24	
$a'b'$ =	15	9
Immersed breadth =	39	9

	ft.	in
cd =	23	6
ab =	21	6
Immersed breadth =	45	

$$\left.\begin{array}{l}A'B' = 57\cdot5^3 = 190150 \\ a'b' = 39\cdot8^3 = \ \ 63045\end{array}\right\} \text{Stability will vary as} \left\{\begin{array}{l}AB = 52^3 = 140602 \\ \qquad 45^3 = \ \ 91125\end{array}\right.$$

Fig. 5.

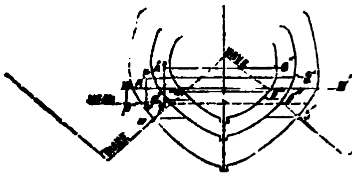
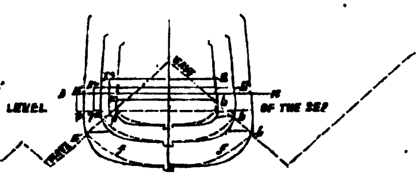


Fig. 6.



in. ft.		
A′B′=57 6	Breadth stability varies as the cube of	=190150
a′b′=46	,, ,,	= 97263
A″B″=43 6	as	= 82881
a″b″=33 6	to	= 37933
A‴B‴=34	as	= 39301
a‴b‴=26	to	= 17576

ft.	
AB=52	140602
ab=52	
AB=40	
ab=40	
AB=30	
ab=30	

Fig. 7.

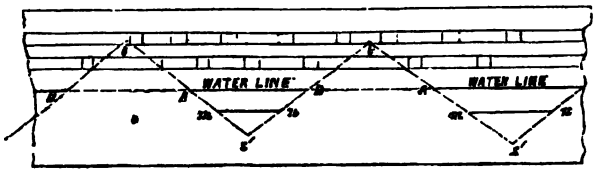
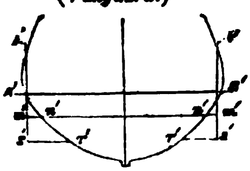
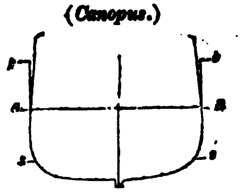


Fig. 8.
(*Vanguard.*)



ft. in.
A′B′=57 6=190150
n′n′=47 6=107170
r′r′r′=30 6= 28652

Fig. 9.
(*Canopus.*)



AB=140602
s . s a shade less.

Let it be supposed that figs. 1 and 2 represent the middle transverse sections of two ships with the sea on their side; that is the ridge of the wave parallel to the line of their course, and that each of these figures represents all the other sections of those ships respectively; the sections in each ship being similar in character, the difference of the sections in one from those in the other will be one of degree and not of principle, so a single section in each may fairly be taken to represent all.

Let it be supposed that the ridge of the wave, which we assume to be one of the highest, viz., 15 feet above, and 15 feet below the mean level of the sea when smooth, has arrived at the centre line of each. A B and A′B′ their respective water-lines, or greatest immersed breadth, would in smooth water be at the mean level of the sea, but as the sea rises they must rise with it, for the displacement must always be equal (subject to a little change due to their greater or less velocity, which, however, does not affect the argument, as each are alike subjects of this change), they will have been raised in this particular case through the distance *u p* and *u′p′* respectively, that is, until *x* and *x* are equal to *x′* and *x′*, and *y* and *y* equal to *y′* and *y′*, and having been thus raised *a b* and *a′b′* will have become the greatest immersed breadths. In the latter case of fig. 1, *a b* is equal to A B in the former, therefore her stability remains a constant, while *a′ b*, in the latter case of fig. 2, is much less than A′B′ in the former case, therefore her stability will be much less. Stability varies as the cube of the breadth, therefore the stability of fig. 1 will remain the same under either set of circumstances, but that of fig. 2 will be reduced in the ratio of 9 to 19, or 97263 to 190150.

The figures 1 and 4, and 2 and 3, represent two vessels in the navy in their relative dimensions, and very nearly also in their form, viz., the *Vanguard* and *Canopus*. The centre of gravity of the former is very much higher than that of the latter, and necessarily so, arising from the following circumstances, the result of their respective forms:—

1. Because her decks are wider, and because the beams to give equal strength with those in the *Canopus*, they being shorter, must be longer, therefore each of these must be *heavier*.

2. The greater portion of the weight of each vessel is contained in their respective sides, situated as indicated by the dark lines in the figures, and is evidently much *higher* in the *Vanguard*.

3. Because the *Vanguard's* form below the load-water line will not admit of her weights being stowed so low, and because she has only 70 tons of ballast, while the *Canopus* has 189 tons.

Let it be assumed, then, that their respective centres of gravity are at *o′* and *o*. Then, as the crest of the wave passes across each in the direction of the arrow, the sides, A′ and A, will be sustained, and the sides, B′ and B, will fall, by which rotating motion will be generated in each, but it will be more extensive and quicker in the *Vanguard* owing to the greater weight of her centre of gravity, the greater moments of motion of her sides being with equal weights as $28{\cdot}9^2$ to 26^2 *a c*, and because of her reduced stability.

Let the figs. 3 and 4 represent these two vessels with the wave past the centre lines of each by an equal quantity; (these vessels are represented as upright, but it is obvious they cannot have remained so till the wave had arrived at the position it is represented to be in, yet it may be admitted as being so, for argument sake, as the supposition is more against than for my argument, as it supposes a loss of stability in fig. 4, which never occurs, as is evident from fig. 1) then we have as the greatest immersed breadth of fig. 3, $c'd' + a'b'$ or 29 feet 9 in., and the stability of *Vanguard* is as the cube of 57·6 in fig. 2, to the cube of 39·9 in fig. 3, or 190150 to 63045, while that of fig. 4 is $cd + ab$, or 45, and the stability of *Canopus* in fig. 1, is as the cube of 52 to the cube of 45, or 140602 to 91125, and while the centre of gravity of the *Vanguard* is much higher than that of the *Canopus*, and her stability less on that account, her stability as shown by fig. 3 is less than that shown in fig. 4, in the proportion of 63045 to 91125.

Nor is this form the least more applicable, as it has been thought to be, to small vessels, for similar evils with those mentioned as resulting from the *Vanguard*,—which vessel it is said rolled through an arc of 45°, while, under similar circumstances, the *Canopus* rolled only 25° or 30°,—will occur in them. In figs. 5 and 6 we have sections of a

frigate and a brig, of each kind; from which it appears, that while the stability of the *Canopus* family remains equal, whether the water be rough or smooth, that in the *Vanguard* family is less by one half in a sea of the height represented in the figures; the rise above the mean level of the sea in each family is about equal, but the smaller the size of the vessel, or, more correctly, the less the beam, the higher they will rise; the respective rise being as $s'p'$, $s''p''$, $s'''p'''$.

From fig. 6 it appears that for ease and stability in a given height and length of sea, the sides should *be perpendicular to a given depth below the load-water line, and to an extent great in proportion to the breadth; and the weights below the load-water line should be great in proportion to the height and quantity of weight above it.* The portion of the bottom below the point of intersection of the side by the wave may be given any form to, that is required, according to circumstances, as at $f\,f$.

It may be said that this applies only to one condition of these ships, viz., to the sea on the side; we proceed then to examine the effect of the sea a head, which will be sufficient, as all cases will fall between these, or the amount of effect in any other cases will be somewhat between the amount in these two cases.

Let fig. 7 represent a section of the length of a two-decked ship, such as the *Vanguard*, showing the waves, t and t, and the hollows between them, at s' and s', passing along the side—that is, the water comprising the waves will be alternately above and below the load-water line, and the support it will afford will depend upon the form; thus, in fig. 9, the wave rising above or falling below, makes little difference in the amount of the support, because the side is perpendicular from t to s, the range of the height to the bottom of the hollow: not so, however, in fig. 8, in which very much more support is lost by its fall below than is gained by its rise above the water-line. In fig. 8, t' and s' correspond with t and s of fig. 7, and $r'\,s'$ indicates the loss of stability at that point: the curve of the sides, intercepted by the perpendicular from D′ to t', taken in connection with t B A (fig. 7), shows the gain of stability by the rise of water above the load-water line, while B′ $r'\,s'$ (fig. 8) taken in connection with A s B, shows the loss by the hollow of the wave below the water-line.

Stability varies as the cube of the breadth; therefore $n'\,n'$ could not be taken as the mean between A′B′ and $r'r'$; but as the area of $m\,s'\,n$ is only one-third that of A m n B, and as there is a slight increase of stability shown by the curve above the water-line, $n'\,n'$ may be taken as showing the stability of fig. 8 under the circumstances described.

The stability of the *Canopus* would be nearly equal under all circumstances, while that of the *Vanguard* would vary in this case from that of smooth water. It is quite true that the sea is seldom so high as that represented in the figures, but it is necessary to determine the greatest height of sea and least length of wave, in order to determine the best form. Thus, except under the circumstance of completely smooth water, the *Vanguard* form cannot be a suitable one; now, smooth water is the exception and rough the rule, so the difference to be attended to is one of degree.

Though the form of the *Vanguard* family of ships is so evidently defective, sailing-vessels of that form have been built for the Royal Navy at a first cost of 5,000,000*l.*, to which must be added the cost of an unusual amount of repairs and alterations rendered necessary by original faultiness of construction, which has been certainly not overstated at 2,000,000*l.*,—very much of which, as has been justly stated, would have been prevented by the old Navy Board, who, if not remarkable for eminent success, contrived at least to steer clear of such eminent failures as those we have recently witnessed. Be the inefficiency of that Board as it may, there can be no doubt that much of it was owing to the inefficiency of its members; yet where was the *necessity* for their being so, and how are their duties better provided for? What elements in the construction of the Board of Admiralty constitute it a better Board for determining questions of naval architecture? Absolutely none; while the members have other duties which preclude the possibility of their giving sufficient attention to the subject. *The fault has been in supposing that every captain or admiral was capable of solving all questions on naval construction*, which is about as reason-

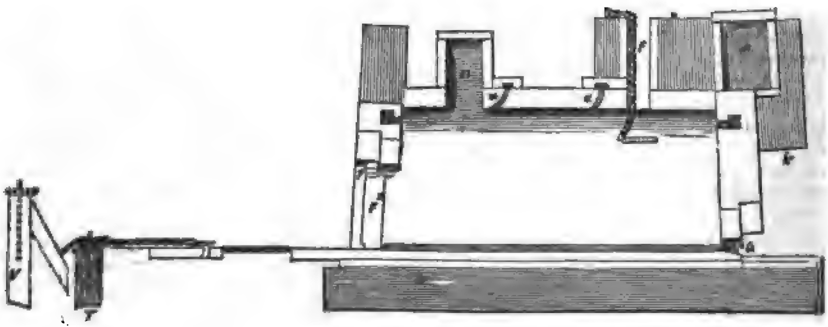
able as to suppose that every dignitary of the Church of England is capable of designing a cathedral equal to that of St. Paul's, or St. Peter's. But why charge all the failures on the Admiralty, or Somerset-house, or even the Surveyor of the Navy? Few men but would have been persuaded, they not knowing better, that Sir William Symond's ships were perfection, by the reports made to the Admiralty, and published in a work called "Facts *versus* Fiction;" therefore much of the blame attaches to those who made these reports and recommendations. Nor is there any prospect of improvement till there is a suitable person to examine such reports, collect and collate the "facts," and throw the "fictions," which form by far the larger portion, to the wind.

E——.

FISHER'S PATENT IMPROVEMENTS IN COKE OVENS.—(CONCLUDED FROM. P. 149.)

In drawing the ovens by the means described under the fourth head of his specification (see *ante*, p. 148), Mr. Fisher makes use of one or other of the posts, T and V, shown in fig. 4, as being fixed in the ground opposite to the mouth of the front of the oven.

Fig. 4.



When I draw from underneath the coke, I use the post, T, which is in a line with the floor of the oven, and has a pulley on the top, which serves to direct the rope or chain to any suitable motive power; and when I draw the coke by any apparatus thrown over the top of the coke, I use the post, V, which is raised above the ground to about the level of the top of the coke.

The *fifth* branch of Mr. Fisher's invention consists in

the employment of a new arrangement, construction, and formation of materials in the construction of coke-discharging apparatuses, whereby the same will be rendered, under all possible circumstances, more durable than those in common use, and may be protected to a great extent from the effects of the extreme heat to which they are exposed when in the oven. Instead of making the draw-plates and rods of solid metal, he makes them of hollow metal, or other suitable material, and rams each piece full of fine sand, well dried, or pounded brick, or any other substance in a pounded or granular state, which is a slow conductor of heat. He then closes up the piece hermetically, or with the exception of a small vent-hole, which is left to allow of the escape of any steam or rarefied air which may be generated in the interior. Mr. Fisher states that hollow plates and rods thus charged, will last uninjured for a much longer time than when made solid, as usual.

Mr. Fisher describes, *sixthly*, an improved machine, to be used in connection with coke ovens, for lifting and removing the tiles employed in closing and opening the different apertures into the ovens, whereby "a great part of the breakage of tiles which now takes

place is avoided, and the consequent loss of materials, time, and labour."

The last head of Mr. Fisher's specification embraces an improved method of cooling the coke after it has been manufactured.

At present the cooling is ordinarily accomplished either by throwing water, in large quantities, into the oven, or by throwing like quantities of water on the coke when drawn out on to the floor in front of the oven, or by transferring the coke to a cold oven, where it is left to cool, by effluxion of time, or by leaving the coke to cool in the oven where it was manufactured, and shutting up that oven as far as practicable from the external atmosphere. But by the first of these processes, the oven is damaged in its structure by the sudden flashing of the water into steam; by the second, the coke is injured in appearance and quality; and by the third and fourth, the atmosphere is never sufficiently excluded to prevent combustion going on in the coke to a greater or less extent after all combustion should have entirely ceased. I obviate these defects in the existing processes by employing, in manner following, the agency of either steam or carbonic acid gas, to put an end to the combustion. If steam is to be used, I connect the coke oven by a pipe with a steam boiler, heated by the waste gases from one or more of the ovens, or in any other convenient way; or if carbonic acid gas, I connect the oven by a pipe with some adjacent lime-kiln, or, failing that, with some furnace, to the coal, in which I sometimes add a little coke, or charcoal, or lime. Each pipe is provided with a cock, to shut and open the communication as required. A fan may also be attached to the connecting pipe, in order to produce the necessary draught. As soon as the coking process has been finished, I close up all the openings into the oven as completely as I can, and then let on the steam or carbonic acid gas, as the case may be, either of which speedily expels the atmospheric air from the oven, and puts an end to the combustion.

THE BRITANNIA BRIDGE—PROGRESS OF THE WORKS.

[Although the Britannia Bridge for railway traffic across the Menai Strait does not yet hang in mid air, there has been no real delay in the process of raising it. On the contrary, while the process adopted is somewhat slower than that originally contemplated, it is one that takes an efficient guarantee against calamity. The published accounts are for the most part very confused and inaccurate; but our readers will be able to understand what is going forward from the account with which we have been favoured by a scientific correspondent.]

The tube, by the operation of floating, was left resting at the foot of the towers, each end being there supported on a shelf of stone, so that at the highest state of the tide there was a space of about three feet between its bottom and the water. Here, until last Friday, it remained while the preparations were making in the upper part of the towers for raising through the 100 feet necessary to attain the "103 feet above high-water spring-tides" demanded by the Admiralty, both in this case and in that of the Menai Bridge.

These preparations consist of an hydraulic press of immense power in each tower, with the steam engine and pumps necessary for the working of each; and of the lifting-chains which hang down from the presses and take hold of the recumbent tube below. These chains had to be put together on the top of the tube, and then got up from thence into their dependent position. They do not consist of short links one within the other, like a common chain, but are like those of a suspension bridge, the links being six feet long.

The hydraulic press is placed in the highest part of the tower, so as to be clear above the tube when lifted into its ultimate position. It consists of a close cylinder of great strength, with a ram or solid piston working through a water-tight collar in the top; the ram bearing across its top a cross-head or beam of cast and wrought iron in combination, to each end of which is fastened the upper end of each line of lifting-chains, of which there are two at each end of the tube. The immense scale of the whole thing may be judged from the fact that this cross-head alone weighs more than 15 tons, and the two lifting-chains at each end about 50 tons; of themselves they look quite a sufficient load for the press without the 1,800 tons below. As this ram rises from the pressure of the water thrown into the cylinder by the pumps, the cross-head rises too, carrying up with it the chains and therefore the tube, till a "stroke" of six feet is completed.

Here the operation stops; and means are taken to secure the chains at the foot of the press, while the ram is being lowered to the bottom of the cylinder again. This is done (and in less time than its description has taken) by clipping the links of the chain with "clams," which are blocks of iron able to be brought near together by a screw like the sides of a vice; they are supported

on the beams on which the press rests, and are made to fit under "shoulders" or notches at each joint of the chain. This being done, the ram is lowered down, the top length of chain above the clams taken off, connexion again made to the cross-head, and all is ready for another lift. It was the original intention of Mr. Stephenson, having once begun to lift, to do so at both ends simultaneously, and so to continue, making consecutive lifts as fast as possible, by which the whole would have been accomplished in about eighteen hours: but the terrible consequences of any failure in the chains, during the time when the dead weight would have been hanging on them, has made him adopt a slower method, in which one lift of six feet is made in the twenty-four hours, first at one end and then at the other; the tube being followed up underneath by wood packings, which during the remainder of the day are taken out and replaced by solid masonry. The lift takes on an average 38 minutes. The operation was begun on Friday evening, and the whole height reached to-day (16th August) is 27 feet; everything having hitherto proceeded without the least impediment or failure.

The second tube, which will be the continuation of this one, will be floated immediately after the raising is completed—probably about the middle of September; and it will be lifted without any delay.—*Spectator* (August 18).

Since the above was written the following account of an unfortunate interruption to the progress of the works has appeared in the *Liverpool Journal*:—

Bangor, Friday Evening,
Aug. 17, 1849.

"All the fond and desired hopes of a successful realization of raising the monster tube of this stupendous bridge to its final resting-place are, for the next two months, at least, suspended.

"A few minutes before noon of this day, the lower part of the cylinder of the huge hydraulic press on the Anglesea side burst with a tremendous explosion, and in its descent on to the tube, a height of about 84 feet, fell with a terrific crash. The press was at work at the time, and had raised the tube about three feet during the lift this day; and had it not been for the very urgent and precautionary means adopted by packing and bricking under with cement as the tube was being raised, the most dreadful consequences were inevitable.

"One of the workmen was precipitated from a rope-ladder running from the top of the tube to the recess in which the hydraulic machine was fixed; he was struck by the huge mass of iron in its descent, weighing nearly three tons, and now lies in a dreadfully crushed state.

"Mr. Frank Forster, the resident engineer, with his staff, were quickly on the spot, and I am happy to add that no other accident has happened.

"This most disastrous affair is to be attributed entirely to a defective casting of the cylinder, and the raising of the tube will, consequently, be delayed some time until the completion and fixing of the new one in its place. The tube is now raised about 21 feet from the base."

LAW OF PATENTS.—REPORT OF THE COMMITTEE ON THE SIGNET AND PRIVY SEAL OFFICES.

Extracts from Minutes of Evidence.

(Continued from page 160.)

Thomas Webster, Esq., Examined:

On other grounds the caveat is of no use; because a caveat is entrusted really to the Attorney-General's clerk. Now, the Attorney General's clerk is a most excellent officer for those matters within his knowledge; but inasmuch as the generality of the title, or the generality of the notice under a caveat, rests with the person giving it, it often happens that the Attorney-General's clerk cannot know what may be included within the title, or what may be included within the caveat. Therefore persons adopt as general titles as it is possible, and as general caveats are given as possible. I think the whole system of caveats as at present administered highly objectionable, and that it fails to attain the object in view.

Is there any notice of applications for patents published?—There is no notice of applications for patents published.

Would there be any objection to its being made necessary that a notice of application for patents should be published?—I do not think there would. I may say that there was a discussion last week at a large meeting at Manchester, to which I was invited, on this very subject. It is a very difficult question, and it has not yet been announced to patentees generally, so as to ascertain whether there would be any objection. I do not see at present any objection to advertisements, that certain patents were being applied for, for a particular subject, or perhaps that even certain persons were applying for a patent for particular subjects, if they had protection of a previous date. But, as the matter rests now, the grievance is this, and it is a very great grievance on a *bonâ fide* invention. A person who enters a caveat, not for honest purposes, but to

get information as to what is going on, gets this insight—that A B is applying for a particular patent; he has nothing to do then but to set to work to bribe A B's workmen to discover what is going on. I have good grounds for believing that this is a case of not uncommon occurrence. If you look at the evidence given before the Committee of the House of Commons, in 1828 or 1829, it was stated broadly that that was done; that individuals had floating caveats to catch information as to what was going on.

Supposing a patent should date from the first application, do you see any objection to that?—I think that should be the case, and that it is one of the most substantial and obvious reforms. The meeting at Manchester was almost agreed, that with respect to a patent there should be protection from the date of presenting the petition and the declaration. But then that must be accompanied with another step, which is, that when a party presents his petition and makes his declaration, he should be obliged to leave a deposit, stating the heads of the invention.

Would you not have the specification much more precise on the first application? —I think not. I think that would be almost impracticable in some, and very inconvenient in most cases.

As the Committee understand, nothing more is required upon the first petition than a statement of the subject proposed for a patent?—It is merely a title, which it is the object of the party to make as general as it can be.

What would be the objection to a more precise specification, provided the applicant were protected?—Because it would be very embarrassing to call upon a person to make a precise specification at the time when he lodges his petition. As the law now stands, a person has no protection till the date of the patent; and if any part of his invention should get out during the course of the experiments he might be deprived entirely of his right. He is not in a position in many cases to make a complete specification till he has got his protection, by having the patent sealed, when he may entrust workmen to make the experiment. If he were obliged to lodge a complete specification by which he would be bound, he might be unable to do that. You cannot make exceptional cases. In many instances, in some cases of a mechanical invention, there would be no difficulty; but in the case of a chemical invention a person cannot lodge such a specification as shall give sufficient information to the public, till he has had an opportunity of ascertaining, from experiments, under the protection of the patent, many practical details and suitable arrangements for the particular nature of the invention.

Would it not be practicable to obtain a specification that described the general principles upon which it proceeded, without describing all the details of the operation, and which would come in the specification which was afterwards lodged?—Yes, I think it would.

I mean something not quite so vague and general as at present?—I think he should be bound to deposit the heads of his invention. The Attorney-Generals of late years had introduced the practice of requiring parties who are opposed to make a deposit; and if a proper system of deposit were required in all cases at the first stage, I think that would meet the object in view. What you want to do is, to afford protection to the party in respect of what he has actually invented at the time, and from that date; and you want to exclude him from stealing other persons' inventions, or putting into his patent what he had not invented when he applied for it. Those are the two objects you have in view, and I think they would be fully answered by requiring a person to make a deposit specifying the heads of his invention, by which he would be bound afterwards.

The Committee have been given to understand that when a caveat is entered against a patent, and opposition is entered, the Attorney-General requires a deposit, that is to say, some description of the principle upon which he is proceeding?—Yes; I believe the deposit, according to the present system, to be wholly inoperative. I have known cases of deposits being produced in Courts—in one case before a Committee of the House of Commons—which, to my knowledge, from the changes that had taken place, must have gone through the hands of four Attorney-Generals' clerks. It was brought there by an assistant to Sir William Follett's clerk, and it had been opened several times. The whole practice of that system of deposits was introduced on a sudden by the present Lord Campbell, to meet a most serious grievance, but it is wholly inoperative, and leads to other grievances of a serious nature. It was a sudden attempt to cure an evil, and it has introduced many others.

What is the duration of a caveat?—Twelve months; it is renewed every twelvemonth. As the Committee are upon that point, I would remark upon the caveat: as I have suggested what appears to me to be one remedy for a serious grievance as regards the application for patents, I would suggest another as to caveats. It is a great hardship that a person should be allowed to enter a general caveat, and not deposit *in respect of*

what he enters it. If, on the one hand, the patentee were bound by the deposit made in the first instance, the person who enters the caveat ought also to be bound from that time by the matter in respect of which he enters the caveat. The patentee ought not to enter a general title which may embody everything. No Attorney-General could object to the title, "For improvements in steam-engines," because the person could not give a better; and no Attorney-General could object to a caveat against "Improvements in steam-engines?" but in the present state of "Inventions" it is monstrous for a man to be allowed to have a title for so general a head, or to bring a caveat under so general a head as "Improvements in steam-engines."

You stated just now that is was desirable that a person should not be able to introduce in his specification any invention which had occurred to him subsequently to his application for a patent?—Yes.

Do you think that that object is attained by the present system?—Certainly not; there is no deposit in any case in which the patent is not opposed; and it is a matter of constant consultation and advice which parties come and ask for, as to what they can do, what they may venture to put into the deposit, or as to what they may put into the patent. But there is no deposit at all except in case of opposition. I know for a fact that parties are in the habit of entering caveats for the sake of compelling parties who are going to take out patents to make a deposit; but that is not ensured, because the deposit is a document very much disregarded. A patent agent told me the other day that he had insisted upon making a deposit with the Attorney-General, which amounted to little more than a piece of blank paper. The principle of the law as to what may be included in a specification was fully considered in the case, before Lord Tenterden, of Crossley *v.* Beverley, about a gas-meter. It was said that a person must not introduce into his specification anything that he had not at the time of the patent being granted; but then it was limited to this, he must not introduce a totally new head of invention, he might perfect his mechanical details, and it was for that reason that the time was given to specify; the Commissioners could not have a more instructive case than that to explain the hardship of requiring a complete specification, or the necessity of having some heads of the invention at the time, and from the first instant. The case of Crossley *v.* Beverley will at once explain the whole difficulty. The title of the patent of Mr. Clegg was simply "An improved gas apparatus," but the invention consisted of several things; an apparatus for measuring gas, an apparatus for purifying gas, an apparatus for generating gas in a more economical manner, and an improved retort. There were four things, each of which, as well as the whole, was an improved gas apparatus. The great feature of the apparatus for measuring gas was the causing a disc to rotate in water so as to measure the gas. It was said that some of the details had been introduced subsequently to the time of obtaining the patent; that was admitted; but the principle was the same. The measuring of the gas was effected by causing a cylinder or disc to rotate by the difference of the specific gravity of the chamber filled with water, and the specific gravity of the chamber filled with air, and by the pressure of the gas upon the drum so balanced. It was said that you might have 500 different ways of introducing the gas, and 500 differently-shaped chambers, and 500 different means of taking the gas out; but those were all the mechanical details incident to the general idea of measuring gas, by causing the drum (part of which was filled with water, and part with gas) to revolve by reason of the pressure of the gas between the under side of the chamber and the upper surface of the water. In that case it would have been a very great hardship to require a complete specification in the first instance. Beyond question the inventor could not at the time when he applied for his patent have specified the mechanical details of the means by which he was going to let the gas in, and take the gas out; but he could say, "My invention is measuring gas by causing the drum to revolve the several chambers in water." He might have been very well required to make such a deposit; but then it would have been a great hardship upon him to require him to insert what he was allowed to do afterwards—to insert in his specification the details of improvements for carrying out that principle. In that case I recollect hearing Lord Brougham say (he was counsel for the defendant in that case) that it was a monstrous decision; but in point of fact his Lordship had forgotten since that time the precise facts. The case is now well-established law; it is now perfectly well established, that any improvements made during the interval for carrying out the principle of the invention, provided there has been no fraud practised on the Crown or the public, may be inserted in the specification.

Is it because the principle is original?—Yes.

And therefore anything the applicant can connect with the accomplishment of the object under that principle is protected by the

patent?—Yes; if the Committee want to know what a man ought to insert in his deposit, they cannot have a better illustration than that case. A man comes to the Crown and says, "I have invented an improved gas apparatus." "What is it?" I say there out to be deposited in the first instance a statement as to what are the details of it. He says, "I have invented an improved gas apparatus." "What is it?" "It first consists in a particular mode of measuring gas; secondly, in a particular mode of generating gas; thirdly, in a particular mode of holding gas by means of an improved retort; and fourthly, in a particular mode of purifying gas by means of lime purifiers." He ought not to be required to do more than that. If he did that he could not insert in his title some totally different thing, namely, an improved mode of burning gas, which would be an improved burner.

Where the title is very general and the patent is unopposed, is there not very great latitude now afforded to a patentee to introduce new matter into the specification?—Where the patent is unopposed, or where there has been a patent with a similar title at the Great Seal, which has been sealed notwithstanding the caveat at the Attorney-General's, a man may introduce almost anything whatever under a general title, as "Improvements in steam-engines," or "Improvements in gas apparatus," or "Improvements in railways." It was only the other day that a gentleman consulted me on this subject. He said, "I am not opposed, and therefore I can insert anything I like." He was at liberty accordingly during the six months to see what he could get in, either by borrowing or buying, so as to add to his own invention; and there having been no opposition, or no deposit, he was perfectly free to insert anything he could obtain.

The specification is entirely drawn under the direction of the patentee; there is no check upon him whatever?—None whatever; and therefore where there is no deposit he can insert anything whatever in his patent. I may mention in illustration of this another case. There was a title for "improvements in electric telegraphs," which is now a very great subject of investigation, and there had been a deposit, I think, in that case by a person who had got hold of an invention which it was very questionable whether it was within his title or not. He was advised, knowing the uncertainty of the present condition of deposits, to run all risks, and insert this invention in his specification, notwithstanding his deposit, and notwithstanding the doubt whether it was within his title; because if he did not do so he knew that another person would insert it in the specification of a patent of a later date. I do not know what were the merits between the two parties, but that was the fact. The invention was not inserted under the doubtful title, because the party came to an arrangement under my advice with the person who had a patent with a title that would certainly hold it, and who was not hampered with a deposit.

The two patents, in fact, were consolidated?—This particular invention was not put into the patent that was first intended, although he had been advised to do it, notwithstanding his having a deposit, and notwithstanding his having doubts of the sufficiency of his title, because he came to an arrangement with another party; but these are matters of daily occurrence. It would not be proper to mention names; but the patent agents can tell you of many such cases.

Would you abolish general caveats with the Attorney-General?—Entirely.

What would you substitute to give notice to the world and to persons interested, in case of an application for a new patent?—I would give protection from the time of presenting the petition, and require the party to make a deposit of the heads of the invention with the petition at the Secretary of State's Office. I would then allow a system of caveats after that stage; general caveats, with a detailed account of the heads of the invention in respect to which parties meant to oppose. The state of the case would then be this: a person having an invention, and applying for a patent for an improved gas apparatus, having put into his deposit, as in the case I mentioned before, those four heads of the invention, would be secured; and the person having entered a caveat for a gas apparatus would have specified in the deposit with the caveat what was the particular improvement in a gas apparatus it applied to; and then you would have on paper that by which each party would be bound, what were the particular improvements for which the one was applying for a patent, and against which the other had entered a caveat. That would be clear of either interference on the face of the paper or non-interference. If a system of general caveats were adopted, I would work it in that manner, but it should be at the same time and office as that at which the original application and the original deposit were made.

That implies the necessity for the publication of notices?—No, the party would do that at his own risk; only those parties would have notice who were prudent enough to enter caveats. If I adhered to the system of caveats, which would throw it upon an

individual to be cautious, and to look out lest he should not have notice, if he did not enter a caveat I would require him to specify in respect of what he entered his caveat. General caveats, I think, should not be allowed against all the world and against general inventions, for the same reasons that I would not allow a person to have a patent for a general title without specifying upon what improvements he applied for a patent.

That would be a system of general caveats accompanied with a specific description. The caveat would be against all the world, but it would be accompanied with a more precise description than is at present lodged by a person entering a caveat?—Yes; it would be a system of general caveats against all the world, in respect of particular inventions, entered at the risk of the party, but limited by the specification of the matters in respect of which he entered the caveat; and it ought to be on this ground: I am about to apply for a patent, but have not sufficiently matured it for or in respect of some particular thing. That is the way in which the system of caveats, I think, ought to be limited, to avoid the consequences which now unquestionably exist; but I think it is open to consideration whether, in lieu of a system of caveats, there should not be a system of advertisements, either in the *Gazette* or by some other means; either that a patent was being applied for, for a particular matter, and would proceed unless opposition were entered to it, which would be much more efficient (but I think it questionable on some grounds, and therefore ought to be fully considered), that A. B., was applying for a patent for such an invention, giving the title. The only object of having the advertisement that A. B., was applying for a patent for a particular subject would be protection to the real inventor, in case A. B. had stolen it from anybody. The theory of caveats is this, that a man who has an invention in his mind, and who may be in such a position that a workman may obtain information, may, to prevent his being defrauded, enter a caveat. That is the only ground upon which it ought to be published to the world, that A. B. was applying for a patent.

There should be some notice to the public that application for a patent has been made?—Yes, if you abandon the system of caveats.

You say, "If you abandon of caveats." If you abandon the system of caveats, it may happen that a person not disposed to enter a general caveat might be disposed to enter a special caveat?—There is no objection in the world to entering a special caveat, because a special caveat goes upon this theory: supposing I had invented an improvement in railways, and I suspected that one of my workmen was also trying the same thing, and was going to steal it, I should enter a caveat against C. D., my workman, having a patent granted to him that was for an improvement in railways without notice to me. The theory of special caveats rests upon an entirely different footing to general caveats.

Supposing that the system of general caveats were abolished, and notice to the public were substituted, and supposing at the same time that a deposit, containing a tolerably specific description of the invention, was required, from every applicant, would not that system suffice in all cases except where there a suspicion of fraud?—Yes, in all cases.

In cases where there was a suspicion of fraud, might it not be competent to an opposing party to apply to the Attorney-General to disclose the name of the applicant, upon special grounds?—Yes, it might, certainly.

Supposing, for example, there were reasonable grounds to suppose that an invention had been stolen, in that case might not the party whose interest was supposed to be affected apply to the Attorney-General for the disclosure of the name of the applicant?—Certainly he might.

Would not that reconcile the sufficiency of a general notice with security against the fraud you indicated!—Yes, I think it would; but I think that perhaps both systems might be combined in this manner, by giving a protection from his first application, on his making his proper deposit, then giving notice at the last stage, or a late stage, before the patent was sealed, that A. B. was applying for a patent, which would be sealed unless opposition, on sufficient grounds, was made before such a date. That would meet the case of fraud, and give the inventor the protection required. The hardship is this: a patentee is delayed at three or four successive stages, and anybody may come in on no grounds, or upon grounds, and delay him by a caveat, if he be desirous of finding out what his invention is. Nothing can be more hard against the honest inventor than the present system.

Do not you think that would be the object of disclosing the name of the applicant in the first instance; and would it not be desirable, if possible, merely to give notice of the intention to apply for a patent for a particular invention?—I think the disclosing the name in the first instance highly objectionable, as is now done to every party having a caveat; it may effectually destroy an honest invention, and lead to all kinds of fraud. If I

enter a caveat for improvements in railways, I get notice that A. B., C. D., &c., are applying; that is, at a cost of 10s. I am informed of the name of every person who may be applying for a patent for a similar subject; therefore I look upon the disclosure at an early stage, as it now is under a caveat, to be highly objectionable.

The present system seems to be neither the one thing nor the other; it does not provide a notice to the public at large, but it does provide a notice to any person entering a general caveat?—The present system does not afford the protection intended by giving notice to the public at large, but it gives to a person entering a caveat from dishonest motives precisely the information and knowledge that he ought not to have. There is no security that I shall get information if I do enter a caveat; but if I should have entered a caveat intending to use it for the sake of ascertaining what is going on, or driving persons to an arrangement, then I am certain of getting notice of it.

Have you any remark to make upon the proceedings that take place before the Attorney-General in case of opposition at the report?—No. I think that the Attorney-General is a very proper person from his position to have the matter brought before him in the way in which it is: but I think, looking at the multiplicity of the avocations of the Attorney-General, the frequent changing, and the nature of the office,—and it has not unfrequently happened that it is the very first time that his attention has been directed to that question, or to scientific questions at all; it is a very bad tribunal, and it is a miracle that the business is done so well as it is.

. . . .

What is the nature of the questions that arise before the Attorney-General; are they legal or scientific?—Entirely questions of interference. I go before the Attorney-General, having applied for a patent for an improvement in railways. My invention is some particular mode of fastening the rails to the chairs, for instance; and a person is opposed also for an improvement in railways. It turns out that his invention relates to some method of rolling the rails, and the Attorney-General says, "There is no interference." It happens sometimes, if the Attorney-General is conversant with the details, that he may say, "Well, but the improvement in the rails may also relate to the mode of fastening, therefore I must inquire more into it." If he is not conversant with the subject, the patent slips through. It happens often that though a patent has been opposed, the party opposing finds that the patentee has a material part, or, occasionally, everything in his specification upon which the opposition was made. This frequently arises by reason of the Attorney-General not having sufficient details before him, or sufficient knowledge of the subject to enable him to detect cases of interference. The party appearing before the Attorney-General in support of the application for a patent will wrap the matter up in as much mystery as possible, and make as wide a statement as possible, and this very often succeeds. The Attorney-General does not know the secret. It depends very much upon the way it is stated.

Do you think that the questions which the Attorney-General decides upon the report are questions which a lawyer is most competent to decide or a scientific man?—I think you ought to have a combination of both. The person deciding it must know what in law is an interference before he can say whether there is an interference or not. He ought also to be a scientific man, or to have the aid of scientific men, to know the bearings of the question. For instance, suppose a patent for an improved gas-apparatus, unless he knew the general details of the manufacture of gas, he would not know, when certain terms were used, whether there might be an interference in this part of the process or in that. Therefore, I think, in order to secure justice, you must have a person with some legal knowledge; you must have some combination, either in the same person or in different persons, of legal and scientific knowledge. That you have in the Attorney-Generals, generally now. They generally have before them persons who can furnish at once the information they require.

Does not the Attorney-General often call in the assistance of scientific persons where he entertains a doubt?—I do not think he very often does. I think the business is done, and in a general way he cuts it short by saying, "There is no interference," or "There is," which is frequently a source of injustice, and he drives parties to a compromise.

Do not questions often arise at present as to the construction of a specification?—Not often; because the Attorney-General says at once, "Well, you have had your protection, and I shall do no harm in granting the patent if your patent is valid. I will not decide the legal question whether it be an interference with an existing patent, you have had your protection; you must sue him in a court of law if you are infringed."

Would that be said, if it was a very obvious interference?—If it were a very obvious interference, I have some doubt about it. The Attorney-General is put in a very difficult position. Supposing I was for the ori-

ginal patentee, I should say, "What a monstrous injustice it is for you to grant the patent, and to drive me to legal proceedings!" But if I were for the person applying for a patent, I should say, "What a monstrous thing it is to preclude me! because, if you are right, the other person has his remedy by an action. If you are wrong, my rights are gone for ever." In cases of that nature the Attorney-General generally grants the patent.

If he grants a patent under such circumstances, is he not laying the foundation of future litigation?—Yes; and encouraging litigation to an enormous extent. I know that Attorney-Generals do act upon that principle, and very properly, because their decision in one case is final, and the rights of the party are precluded for ever, if he is wrong. If he is right, he says, "I am doing the less harm of the two, by the course I take."

That can only apply to cases in which there may be some doubt?—Yes; still it is so easy to get out of it, that the Attorney-General, from pressure of business, is very much driven to dispose of it in that way.

Assuming that the questions which come before the Attorney-General at the report, are mixed questions of law and science, do not you think that a lawyer, assisted by the advice of scientific men, is a more competent judge than a scientific man assisted by the advice of lawyers?—I am quite sure that a scientific man, assisted by the advice of lawyers, is not so good a tribunal as a lawyer assisted by the advice of scientific men; and for this reason, the precise limits of the legal questions are thoroughly understood by a lawyer, and he has the means of applying his legal knowledge to scientific facts, but a scientific man cannot understand and appreciate the legal questions.

The English Attorney or Solicitor-General only reports upon patents which are valid for England, the Channel Islands, and the colonies?—Yes.

In case of application for a patent for Scotland, and also a patent for Ireland, a different procedure is followed?—Yes.

Are you aware of any advantage that arises from that system?—None; on the contrary, I think it is a very great hardship, in this respect: as the law is now settled by the recent case of Brown *v.* Annandale, in the House of Lords, it is decided that if an invention be known in any part of the realm, the patent is invalid for every part. Previous to that, inasmuch as the patents for the three countries were distinct, it was always supposed that you might have a patent for Scotland, though the invention were known in England. If that were the law, there would be no great harm in the three distinct proceedings; but not being the law, the obliging a person to go to three references, to be subject to three systems of caveats, and then to have three patents, is a monstrous injustice; and the state of the case is this now,—that inasmuch as you cannot, from the course of practice, have a patent sealed for all the three countries on the same day, you must have, of necessity, the patents sealed on different days in the three countries; and then, inasmuch as the invention relates back for all purposes of title to the date of the patent, you have this awkward state of things, that a party who is proceeding on a patent in Scotland, his patent in this country being of prior date, is met with this objection, that there was publication in this country before that in Scotland.

Do you see any objection to allowing a patent to be granted for the three kingdoms on the report of the English Crown lawyers?—None whatever, the same notice having been given. On the same principle, I think a patent ought to be granted for the three kingdoms on the report of the Lord Advocate of Scotland, or the report of the Attorney or Solicitor-General for Ireland, if a party were pleased to take it there in the first instance. He says, "I am in possession of an invention new in the realm, give me a patent for it." One law-officer is as good as any other.

Would it not create considerable dissatisfaction among English inventors, if patents were granted in Ireland or Scotland by the law-officers of those countries?—I think not.

Are you aware that there are very few inventors in Scotland, and scarcely any in Ireland?—Yes; I am aware that the number of English patents, as to the number of Scotch, is about five to two; and the number of English patents, to the number of Irish, is about five to one. But there are many causes to be assigned for that. In the first place, there are hardly any manufactures in Ireland. There is not the same scope for them. There are comparatively few in Scotland, as compared to England; but there is no reason why a Scotchman, who has made an invention, which, as the law now stands, must not be known in any part of the realm, any more than in Scotland, should not be allowed to refer the matter to the Lord Advocate, and obtain a patent for the United Kingdoms. I do not say whether it should be under the Seal of Scotland; but to be in a position to have a patent for the whole of the three kingdoms, if he was so minded.

Is it not the fact, at present, that if a Scotchman makes an application, he almost

always employs a patent agent in London to take out an English patent in the first instance?—I do not know how that is; but the fact is, that the state of practice is such, that an inventor can hardly ever get a patent without applying to a patent agent in London. I believe it results from the difficulties that exist in the offices of getting a patent through.

Is not an English patent far more valuable than a Scotch or Irish patent?—No, except by reason of the want and absence of manufactures in the particular countries. I have no doubt that there are cases in which the Scotch patents are much more valuable than English. For instance, in one case, Neilson's hot-blast patent, I believe the money received in Scotland amounted to not far short of half a million, but in England it was very small. The great value of the hot-blast was to bring into use, I think, a particular kind of ironstone that does not exist in this country. I believe the English hot-blast iron is inferior to the English cold-blast iron, while the Scotch hot-blast iron is vastly superior, differing in the kind of coal that might be employed, and therefore the Scotch patent was more valuable than the English. It was not till the application of the hot-blast to anthracite, which opened up the coal-fields in Glamorganshire, that the royalty to Mr. Neilson, with respect to hot-blast, was very considerable in this country. Another case I know of a patent which we had before the House of Lords this session, of weaving carpets, Templeton *v.* Macfarlane. I am not aware of its having been worked extensively in this country. I know a case where it was not, Whittock's patent, which the Privy Council extended the other day, where the whole profits were Scotch profits. If a person is located in Scotland, he can supply from his manufactories the whole realm, and therefore the value of the patent which he obtains first will depend upon where the particular manufacture happens to be.

(*To be continued in our next.*)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 23RD OF AUGUST, 1849.

JOHN ERWOOD, of Hoxton, Middlesex, paper-hanging manufacturer. *For improvements in the manufacture of paper-hangings.* Patent dated February 15, 1849.

These improvements relate to hand-made paper-hangings, in imitation of marble, porphery, and granites, and have for their object the production of a paper-hanging of this class, which does not require to be varnished after being put upon the wall.

The paper is first coated with a ground colour; it is then laid out upon a board, and coated with what is distinctively known in the trade as "satin white;" and while this coating is still damp, the veins, spots, and colouring are thrown in. The colours employed for this purpose are mixed with "satin white." When dry, the surface is dusted with French chalk, and the paper is put through a glazing machine, which is composed chiefly of a revolving brush, to the action of which the coloured surface is subjected, after which the paper-hanging is fit for use.

Claims.—The making of hand-made paper-hangings in imitation of marble, porphery, and granites, by means of "satin white;" and also the use of "satin white" for mixing the colours employed therein.

CHARLES THOMAS PEARCE, of Park-road, Regent's-park, Esq. *For improvements in apparatus for obtaining light by electric agency.* Patent dated February 16, 1849.

1. Mr. Pearce employs, like preceding speculators in this branch of applicate science, a disc of carbon, but applied at an angle to the *edge* (not the point) of a bar electrode, and the disc is made to revolve by the same clockwork which winds up the bar electrode. Sometimes more than one disc is applied to prevent the going out of the light. The bar electrode is supported by three platinum wires tipped at their upper ends with irridium, which conducts the electricity to near the point where the light is produced. The bar electrodes are sometimes composed of pieces of different lengths joined together with dowels of the same substance as the electrode is made of. And, sometimes, the patentee uses two pieces of charcoal, of a non-conducting nature, for preventing the two electrodes from coming together. These two pieces of charcoal are pressed forward against the upper end of the lower electrode by means of helical springs, thereby occupying a place somewhat between the two electrodes; and it is supposed that thereby the electrodes will be kept at the proper distance to maintain the light.

2. To produce contact between the electrodes in the event of the light going out, the current maintaining the light is made to pass through a double coil, with an armature connecting them at one end, which armature is connected to the end of a small beam. When the current is not flowing through the coil, the armature is drawn up by means of a spring attached to the beam. The other end of the beam carries a piece of carbon, which in the raised-up state of the armature, comes between the electrodes, completes the contact, and produces the light, at which moment the armature is

drawn down upon its place, and brings back the beam to its original position.

3. A third improvement consists in causing clockwork, together with the battery and the arrangement of the electrodes, above described, to produce an intermittent light. One of the wheels of the work, through which the current flows, is pierced on its periphery with ivory or wood, which, for the space of time the ivory or wood is in contact with the end of a conductor (forming part of the circuit for the current) prevents the flow of the electricity, and, consequently, for that time, the light is extinguished. A similar means is employed for periodically bringing into use, and stopping the action of any or all of a series of batteries employed for producing light.

4. A fourth improvement is in the application of a permanent and an induced magnet so combined, that, together with the aid of wheelwork, the current of electricity shall be regulated.

5. A fifth improvement has reference to perfluent batteries, but the difference (if any) between Mr. Pearce's and those of Mr. Staite, to which the patentee alludes, is very little. Mr. Pearce makes his copper-plates sometimes of a corrugated or zig-zag form, so as to increase the surface; he also uses the muriate of ammonia, and prefers to excite the action by alkaline salts.

Claims.—1. The producing of light at the edges of bar electrodes instead of at the points. Also, the combination of bar with disc electrodes, when the discs are applied at an angle to the bar electrodes. Also, the conducting supports to the bar electrode. Also, the preventing contact of the electrodes by means of a non-conducting substance. And, lastly, the manner of uniting the pieces forming the electrode.

2. The manner of renewing the flow of the current of electricity when the light has been put out.

3. The employment of clockwork to regulate the times of duration of the light, and also the employment of clockwork to regulate the times the batteries are kept in and out of action.

4. The apparatus composed of the permanent and induced magnetic bars for regulating the flow of electricity.

5. The perfluent or sustaining batteries, above described.

Charles Frederick Whitworth, of Hull, gentleman. *For improvements in preventing accidents on railways.* Patent dated February 17, 1849.

These improvements have, firstly, for their object the rendering of the steam whistle and the steam throttle-valve of locomotive engines, partially self-acting and independent in some measure of the engine-driver. The patentee effects this, by inclined levers placed on the side of the line of railway, which, in case of danger, can be placed in such a position that the levers may act upon a trigger and rod, which are attached to the locomotive, and in connection with the whistle and throttle-valve; so that one or other, or both of these may be brought into play, and thereby give alarm, or stop the train. The patentee states, that these objects have been partially accomplished before, but as he has appended no claim to his specification, he has left the public entirely in the dark as to what the *quantum* of "improvements" is which he has contributed.

Another contrivance embodied in the specification consists in fitting a rack and pinion to the bottom of railway carriages, so that, by their help, the carriages may be hooked together, with less risk of injury to those whose duty it is to attend to this duty. But here, too, the patentee has omitted to make any "claim."

John Bottomley, of Bradford, York, manufacturer. *For improvements in machinery for weaving.* Patent dated February 22, 1849.

The improvements set forth in this specification have for their object the saving of a great portion of the thread which is used in the production of coloured figures upon cloth, by means of the Jacquard machinery, as by far the greater portion of the coloured thread employed for this purpose is wastefully or uselessly employed by the looms now in use. Mr. Bottomley's improved loom effects the saving by means of a set of rack and pinion shuttles, nearly, if not entirely, the same as those figured and described in vol. l., page 36 of this Journal, and forming the subject of a registration by Mr. Greenwood, of Dalston.

Claim.—The combination and application of machinery for producing figures upon woven fabrics by means of power looms, as above described.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles Cowper, of Southampton-buildings, Middlesex, for improvements in machinery for raising and lowering weights and persons in mines, and in the arrangement and construction of steam engines employed to put in motion such machinery, parts of which improvements are applicable to steam engines generally. (Being a communication.) August 23; six months.

Frederick Chamier, of Warwick-street, Middlesex, commander in the Royal Navy, for improvements in the manufacture of ships' blocks. (Being a communication.) August 23; six months.

William Edward Newton, of Chancery-lane, civil engineer, for certain improvements in steam boilers. (Being a communication.) August 23; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in manufacturing and refining sugar. (Being a communication.) August 23; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Aug. 16	1998	Henry McEvoy	Birmingham	Parts of collars.
"	1999	Christopher Carney	County Kildare	Thrashing machine.
"	2000	Mapplebeck and Lowe,	Birmingham	Fire-grate.
20	2001	William Neufville Martin	Newman-street	Flower-pot case.
21	2002	Francis Taylor	Romsey, Hampshire	Nipple protector.
"	2003	John Warner and Sons,	Crescent, Jewin-street	Solar lamp.
"	2004	Job Clark and Richard Sidebotham	Willenhall	Design for stamping machinery.
"	2005	George Edward White and William White	Hartley-row, Hants	Ventilating brick.
22	2006	Stephen Carlton	14, Priestgate, Darlington	Carriage spring.
23	2007	John Cordingly	Ipswich	Bathing boat.
"	2008	George Babb	346, Strand	The D'Oyley coat sleeve.

☞ *A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the substance of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d.*

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Edited by J. C. Robertson, 166, Fleet-street.

POLLARD'S PATENT PRESS MACHINE FOR STRETCHING, HARDENING, LAYING, AND CLOSING ROPES AND CABLES.

Fig. 1.

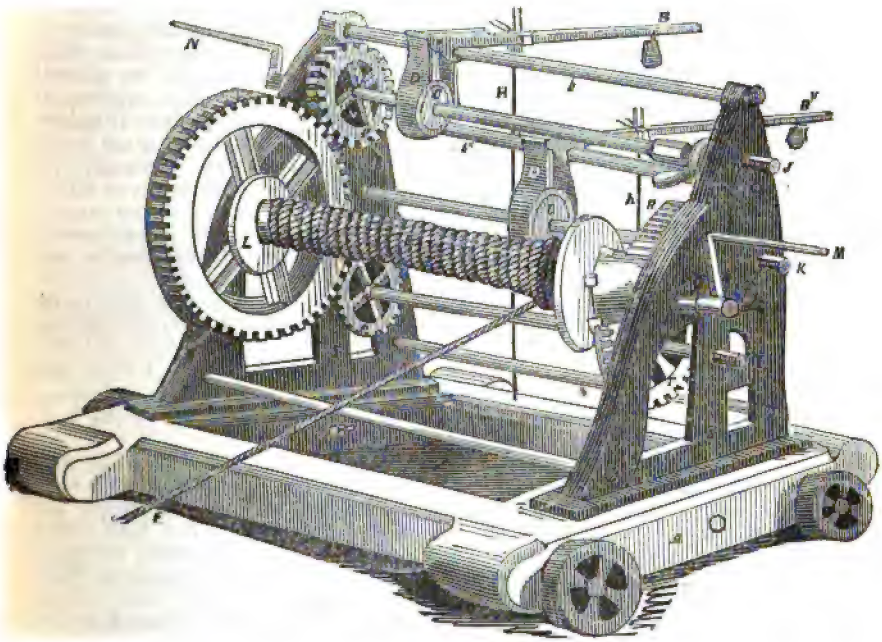


Fig. 2.

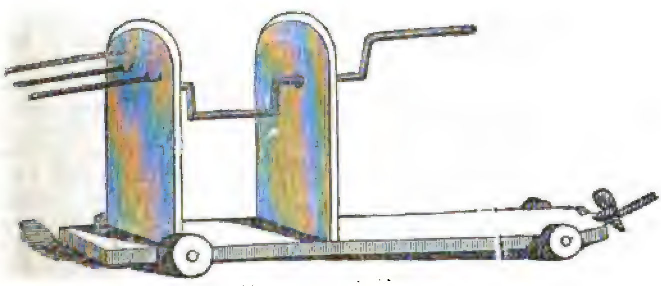
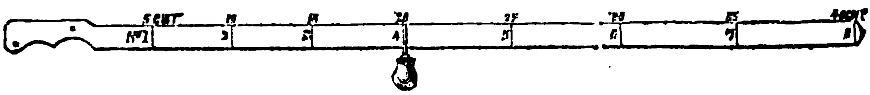


Fig. 6.



POLLARD'S PATENT PRESS MACHINE FOR STRETCHING, HARDENING, LAYING, AND CLOSING ROPES AND CABLES.

[Patent dated February 28, 1849. Patentee, Mr. Robert Pollard, Topsham, Devonshire. Specification enrolled August 28, 1849.]

In rope-making, as now ordinarily practised, a weighted travelling drag is used for stretching, hardening, laying, and closing the ropes and cables, which is of cumbrous construction, very inconvenient to use, and, from the irregularity of its action, the frequent cause of great unevenness in the work.

The object of the present invention is to substitute for this objectionable travelling drag a pressing machine, which, though capable of being readily moved from one place to another, shall be stationary while at work, whatever may be the length of the rope or cable, and which can be set at starting to any required degree of pressure, and will maintain the pressure to which it is set under every variation of circumstances.

Fig. 1 of the accompanying engravings is a perspective view of this pressing machine, and fig. 2 a similar view of the jack used in connection with it; fig. 3 is a front elevation; fig. 4, a plan; and fig. 5, a section of the pressing machine taken on the line *a b* of fig. 3. A, is a basement furnished with wheels, on which the machine is mounted; S S, two end standards; E, a barrel, round which the press rope or chain, F, is wound; M, a crank handle, by which the barrel is turned; L, a cog-wheel attached to the inner end of the barrel; I, J, and K are three revolving shafts, which are supported by the standards, S S, and are all of them parallel to, but situate in vertical planes to the rear of the barrel, E; the shaft, I, carries at one end a pinion, P, which takes into the cog-wheel, L, on the barrel, E, and on the other end, a cog-wheel, T. The shaft, K, carries at one end a pinion, R, which gears into the wheel, T, on the shaft, I. To the shaft, J, is attached the pinion, V, which takes into the cog-wheel, L, on the barrel, E; B′, is a lever weighted on the steelyard principle, to which is attached at one end a strap, D, which grips a friction pulley, C, on the revolving shaft, J, and *b* a cross bar, which serves as a fulcrum to B′; and B″ is a similar lever to B′, which acts through the medium of a similar strap (D), friction pulley (C), and fulcrum rod (*b*″) on the revolving shaft, K; N, is a crank handle, by which the shaft, J, is turned, and which may be transferred as required to either of the shafts, I and K.

Now, as the friction of rubbing surfaces is known to vary with the pressure, and to remain nearly uniform under the same pressure, and as the machine which has been just described can be adjusted to any degree of pressure required by merely changing the position or magnitude of the weights attached to the levers, B′ and B″, it affords, obviously, the means of obtaining any degree of retardation of the jack (in lieu of the dragged weight) required for the manufacture of ropes of all sizes, from the smallest ratline up to the largest cable.

It will be further evident that, as the lever, B′, acts on the barrel, E, through the medium of a single wheel only (V), it must necessarily exert less force than the lever, B″, which is in connection with the whole train of wheels (R, T, V, L, and P.)

The lever, B′, therefore, when used by itself, is adapted for small work only, and the lever, B″, for the larger and more general sizes. But both levers may be used conjointly when very great pressure or resistance is required. When either of the levers is in use by itself, the other is thrown out of action by lifting a paul, Z, on the shaft, and drawing the pinions, P, R, or V, out of gear with the wheel into which they take.

To illustrate the effect of shifting or altering the magnitude of the weights attached to the levers, B′ and B″, in increasing or diminishing the resistance to the rotation of the barrel, there is shown in fig. 6 the lever, B″, on an enlarged scale, graduated from 1 cwt. up to 40 cwt.; that is to say, supposing the weight to be drawn is that of a loaded sledge, such as is generally used by rope-makers, and that the ground over which it has to be moved is a level gravelled walk, of the description of those usually to be met with in covered rope-grounds, then No. 1 on the scale attached to this lever will represent the amount of resistance offered to the rotation of the barrel

of the machine, or strain exerted on the rope when a weight of 10 lbs. is suspended from that point, and the succeeding Nos. will denote the proportional increase of strain produced by moving out the weight one, two, or three degrees farther towards the end of the lever. Thus, supposing the rope about to be

Fig. 5.

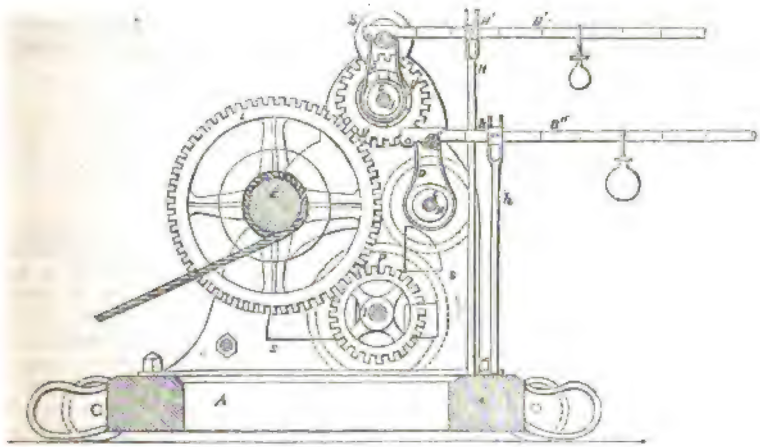
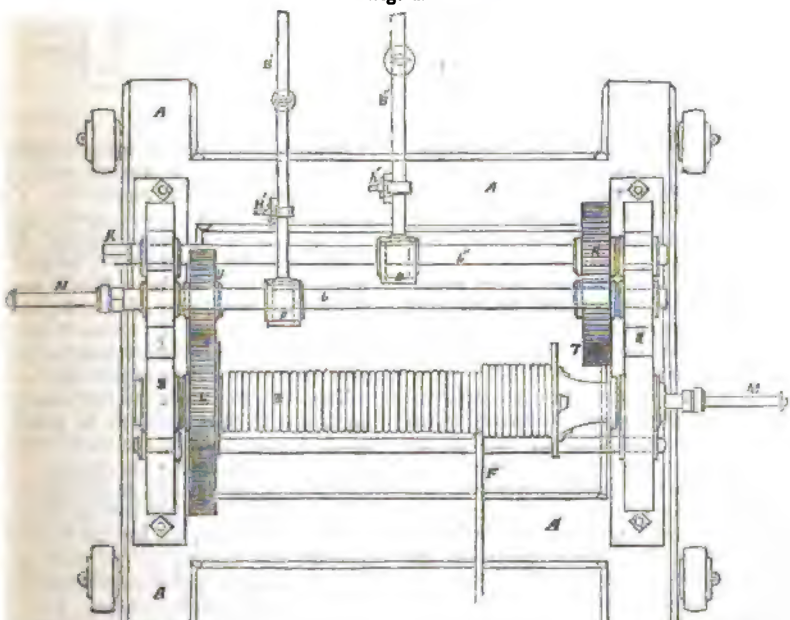


Fig. 4.

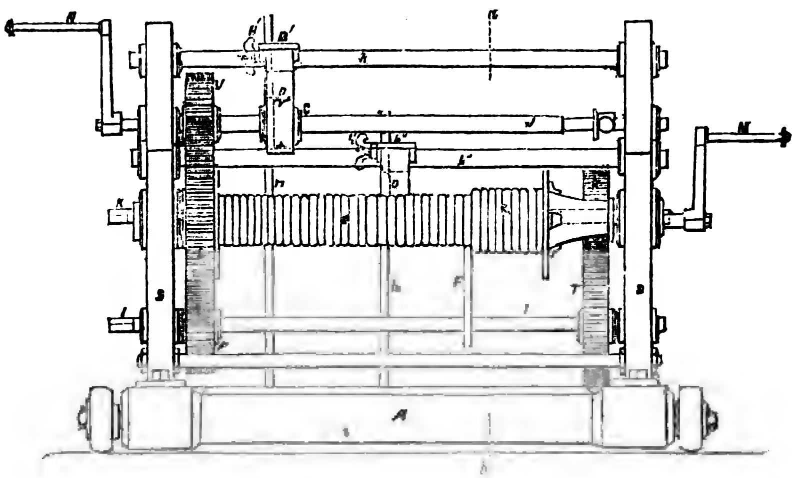


closed is of a diameter known to require a press of 20 cwt., then the 10 lbs. weight must be suspended from the point No. 4, or if double that amount is required, then either the 10 lbs. weight must be pushed out to No. 8, or a 20 lbs. weight must be suspended from the weight No. 4.

A single man, or, at most, a couple of men, will, by turning a winch handle attached to the end of either of the shafts E or J, draw back with the greatest ease a small or middle-sized jack; or, by applying the winch handle to the shaft, K (which is in gearing with the whole of the train of wheels), they will be able to draw back the largest and heaviest jack in use. With the ordinary travelling drag, the same work would require from ten to twenty times the number of hands.

The levers (B′ and B″), after they are once adjusted to any required amount of pressure, are kept uniformly steady by

Fig. 3.



means of the stays, H, *h*, the upper ends of which terminate in clefts, so adjusted to the position of the levers when weighted, that the levers and stays may be connected together by glands and nuts, H′ *h*′.

If at any time the press given should be found too tight, it can be instantly slackened by moving the suspended weight or weights on the lever or levers more or less inwards.

Claim.—I declare that the improvement in rope-making machinery which I claim as constituting my said invention, is that embodied in the stationary pressing machine before described, and intended by me to be substituted for the weighted travelling drag now in common use; that is to say, the employment, for the purpose of my invention, and in manner before specified, of levers weighted on the steelyard principle, according to the exact degree of pressure or resistance required.

Mr. Pollard has made a great many experiments to test the practical efficacy of his machine, and in every instance, without exception, it worked with the utmost precision and regularity. One of these experiments is well worth citing.

A 7½ inch shroud was stretched, hardened, laid, and closed with a weight of 20 lbs. suspended between Nos. 6 and 7 of the lever scale, producing a degree of pressure equivalent to 3 tons 5 cwt. of drag, which is the amount given in rope-work tables for a rope of this size.

The saving of time by this machine appears to be fully one-fifth, in proof of which we may quote another experiment which was made on the 2nd of last month, at an extensive manufactory near Exeter, where the machine has been in constant use during the last three or four months, and applied to the closing of ropes of all sizes and descriptions. Five seven-inch shroud-laid ropes, 110 fathoms long, were passed through the entire process of closing by the patent press *within* the same time which it took to close four ropes of the same size and length by the old process.

ON SYSTEMS OF QUADRUPLE ALGEBRA.

Sir,—Even if they serve no other purpose, the following remarks may prove useful as affording exercises of an easy character in the Theory of Symbols, considered in all its generality. In the pressure of other pursuits and occupations, I must seek my apology for their fragmentary character.

If α, β, and γ be three imaginaries of which the respective squares are equal either to positive or negative unity, and which are subject to the relation

$$\alpha\beta=\gamma,$$

then these imaginaries afford us four, and only four, essentially distinct systems of Quadruple Algebra. The first system is that of QUATERNIONS; the second, that of TESSARINES; for the third system I propose the name of CO-QUATERNIONS; and for the fourth that of COTESSARINES. Adopting the nomenclature which I gave at p. 534 of the last (50th) volume of the *Mechanics' Magazine*, the Quaternion and Coquaternion Systems are *abnormal*, while the Tessarine and Cotessarine Systems are *normal*.

I am, Sir, yours, &c.,
JAMES COCKLE.

2, Warwick-place, Worthing, August 16, 1849.

If, in place of the above equation, we had assumed

$$\alpha\beta=\pm\gamma,$$

nothing would have been gained in point of real generality. For, since

$$(-\gamma)^2=(+\gamma)^2,$$

it is immaterial, so far as the above systems are concerned, whether we write γ with the positive or the negative sign. And the same thing is true of the other imaginaries. But we must, of course, adhere to the sign when we have once selected it.

1. *The First, or Quaternion System.*

The characteristic of this system is that, i, j, and k being its imaginaries,

$$i^2=j^2=k^2=-1 \;\ldots\ldots\ldots\ldots (1.)$$

Instead of $\alpha\beta=\gamma$ we shall now write

$$ij=k \ldots\ldots\ldots\ldots (2.).$$

This being done, multiply both sides of (2.) by i, in this, *and in all other cases*, writing the multiplier first in order. We then have

$$iij=i^2j=ik,$$

or, by virtue of (1.),

$$-j=ik \ldots\ldots\ldots\ldots (3.).$$

Let k be multiplied by each side of (3.) and there results

$$-jk=ikk=ik^2$$

or, by (1.), $\quad -jk=-i$, or

$$jk=i \ldots\ldots\ldots\ldots (4.).$$

Multiply each side of (4.) by j, then

$$jjk=j^2k=ji,$$

whence, as before,

$$-k=ji \ldots\ldots\ldots\ldots (5.).$$

Multiply i by each side of (5.), then

$$-ki=jii=ji^2,$$

whence,

$$ki=j \ldots\ldots\ldots\ldots (6.).$$

Multiply each side of (6.) by k, then

$$kki=k^2i=kj,$$

or

$$-i=kj \ldots\ldots\ldots\ldots (7.).$$

The equations (1.) to (7.) are those of the Quaternion System of Sir W. R. HAMILTON. This system—which is one of great originality, symmetry, power, and beauty—is the point at which the Science of Symbols first burst through the bounds of the old Double Algebra, and sought new fields of research. Its defects are twofold—its *abnormal* nature and the want of concinnity of its dimensions with those of space. But this last defect is common to all systems of *quadruple* algebra.

2. *The Second, or Tessarine System.*

The characteristic of this system is, that

$$i'^2=-j'^2=k'^2=-1 \ldots (8.),$$

where i', j', and k' are its imaginaries. The condition $\alpha\beta=\gamma$ now takes the form

$$i'j'=k' \ldots\ldots\ldots\ldots (9.),$$

and from this last equation it follows* that

$$i'=k'j' \ldots\ldots\ldots\ldots (10.),$$

Multiply both sides of this by k' and we shall have, after reduction,

$$k'i'=-j' \ldots\ldots\ldots\ldots (11.).$$

Multiply i' by each side of (11.) and we have

$$k'i'i'=k'i'^2=-j'i',$$

or, by virtue of (8.), and changing the sign of both sides,

* *Vide supra*, p. 124.

$$k' = j'i' \dots\dots\dots\dots (12.).$$

Multiply each side of (12.) by j' and we shall find

$$j'k' = i' \dots\dots\dots\dots (13.);$$

and from this we may (*vide supra*, p. 124,) deduce

$$-j' = i'k' \dots\dots\dots\dots (14.).$$

Equations (8.) to (14.) are those of the Tessarine System; and, since (12.), (10.), and (14.), which correspond respectively with (9.), (13.), and (11), are consistent with the commutative law of multiplication, we see that the Tessarine System is *normal*. On another occasion I hope to discuss completely its geometrical interpretation. This Tessarine System appears to me to be the natural extension of ordinary Double Algebra. For further information respecting it the reader is referred to the places cited in the note *supra*, p. 124; to pp. 558—9 of the last volume of this Magazine, &c.

3. *The Third, or Coquaternion System.*

In this case, the characteristic equations may be expressed by

$$-a^2 = b^2 = c^2 = 1 \dots\dots\dots\dots (15.),$$

where a, b, and c are the imaginaries. We have, also, from $\alpha\beta = \gamma$,

$$ab = c \dots\dots\dots\dots (16.)$$

To avoid repetition, I shall now use the terms *multiplier* and *multiplicand* with reference to the numbered equation next preceding those terms wherever they are used.

Let a be the multiplier, we have

$$aa\,b = a^2\,b = ac,$$

or, by (15.),

$$-b = ac \dots\dots\dots\dots (17.)$$

Take c as multiplicand, then omitting, as I shall do for the succeeding part of this paper, the intermediate steps, we find

$$-bc = a \dots\dots\dots\dots (18.)$$

With b as multiplier, we find

$$-c = ba \dots\dots\dots\dots (19.);$$

and with a as multiplicand, we obtain

$$ca = b \dots\dots\dots\dots (20.)$$

So, c as multiplier gives,

$$a = cb \dots\dots\dots\dots (21.)$$

Hence, in this Coquaternion System, the commutative character of multiplication is lost, and the system is, consequently, *abnormal.*

To remove all doubts, however, as to the essentially abnormal nature of this system, I shall start from the assumption

$$bc = a \dots\dots\dots\dots (22.),$$

instead of (16.) The meaning of the contracted notation which I shall now use is obvious—the *multiplier* being always placed first. This being premised, the expression

$$b \times (22.)$$

gives

$$c = ba \dots\dots\dots\dots (23.)$$

So, (22.) $\times\, c$ gives

$$b = ac \dots\dots\dots\dots (24.)$$

Again, $a \times$ (24.) gives

$$ab = -c \dots\dots\dots\dots (25.),$$

and (23.) $\times\, a$ gives

$$ca = -b \dots\dots\dots\dots (26.),$$

and, finally, $c \times$ (26.) gives

$$a = -cb \dots\dots\dots\dots (27.)$$

It may be as well to give the following rule for conducting our processes in the above cases. Although in all those cases I have not strictly adhered to it, it will, I think, be useful in practice. Call the relation $\alpha\beta = \gamma$ the equation A. Form the relations

$$\alpha\mathrm{A} \text{ and } \mathrm{A}\beta,$$

and call them B and C respectively. Next form Bγ and γC, and the remaining condition may be found either from

$$\beta\,(\mathrm{B}\gamma), \text{ or } (\gamma\mathrm{C})\,\alpha.$$

4. *The Fourth, or Cotessarine System.*

Let d, e, and f be the imaginaries of this system, then its characteristic is that

$$d^2 = e^2 = f^2 = 1,$$

and we also take $de = f$. Proceeding as suggested at the close of the remarks on the Coquaternion System, we find, successively,

$$e = df, \text{ and } d = fe;$$
$$ef = d, \text{ and } fd = e;$$

and, finally, $f = ed$.

This system is *normal*. One of its defects is, that it takes no cognizance of the expression $\sqrt{-1}$, and consequently has no relation to ordinary Double Algebra.

Concluding Observations.

In the foregoing remarks I have dwelt on the *analytical* character, and not on

the *geometrical* interpretation of the systems. On the latter subject there is, however, one remark which I wish to make here, for the purpose of correcting an oversight into which I have fallen in a note at p. 407 of vol. xxxiv. of the present (3rd) series of the *Philosophical Magazine*.

In the TESSARINE THEORY, the symbols 1 and i' denote, respectively, two points, each at a distance *unity* from the origin, but in straight lines at right angles to each other. Through the point 1 draw a straight line PERPENDICULAR to the PLANE containing the points 1 and i' and the origin. In this perpendicular take a point at a distance *unity* from the point 1. Then j' will represent the point so taken in the perpendicular. In the place just cited from the *Philosophical Magazine*, I have made j' represent a point in the perpendicular *through the origin*. But a symbol (g) which should represent such a point would seem to satisfy the relation $g^2=o$; at least if we adopt the views which I took in my interpretation of Tessarines. But this paper has already extended to too great a length to permit me to enter further into the subject. I may, however, add that by *conical rotation* we may perhaps give a more convenient interpretation and a more symmetrical form to the Tessarine Theory considered in its application to Geometry. But I beg to be understood as reserving for future discussion the whole subject of TESSARINE INTERPRETATION.

THE PRINCIPLE ON WHICH CIVIL ENGINEERS AND CONTRACTORS SHOULD BE REMUNERATED?

The excellent observations on the remuneration of architects which appeared in the *Mechanics' Magazine* of 28th July last, are most of them equally applicable to the mode by which the manufacturing civil engineer is usually rewarded for his skill; this, as is well known, is usually by the profits obtained on the engines and machines he furnishes, a profit sometimes amounting to 50 or 60 per cent. upon them, besides a lesser one as a per centage on the wages of men he finds to put up his work. This mode of compensation, because the amount of it is concealed, is even worse than the per centage to architects, which is at a fixed rate and openly charged. The civil engineer, too, has even greater inducements than the architect to form under estimates, for under the plausible pretext of inventions and improvements, the manufacturing engineer can easily cause the outlay first calculated on to be doubled or trebled in amount. This mode of remuneration has, in public concerns particularly, often led to an extravagant, though concealed amount of reward to some men, whilst other inventors of important improvements have not even received compensation equal to their disbursements on account of them.* Sir Samuel Bentham aware of this discrepance, and that where contracts were given as a reward, "the extra profit upon articles supplied has afforded remuneration enormous in amount," was led to devise means by which real inventions should be adequately rewarded, without subjecting the public to concealed and uncertain expenditure for so-called improvements, but perhaps of little real value. Accordingly in April, 1803, he proposed to the Admiralty, "As a general measure, the giving as a remuneration the exact amount of savings for some specific time, whether, for example, for a year, for two years, or for any longer or shorter period." He stated at the same time that such a measure would "afford encouragement to persons of ability in general for the production of inventions

* For example, the late Dr. George Fordyce invented, on chemical principles, the means of manufacturing charcoal for gunpowder in close iron cylinders, and gave up much time to the Ordnance Department in order that his invention might be made practically advantageous; he was furnished in the year 1786 with documents showing officially the superiority of gunpowder that had been made with charcoal prepared in his mode. The advantages of his invention having been appreciated by the Master-General of the Ordnance, and by all under him, Dr. Fordyce received a letter from the Ordnance-office, acquainting him that *ten guineas* had been awarded to him for his invention! That sum fell far short of his expenditure for travelling to and fro to Woolwich and elsewhere for the purpose of directing the construction of suitable cylinders.—He never applied for or received the contemptible boon. Gunpowder made with charcoal prepared in his manner was, in actual service, found so much stronger than other powder, that captains in the Navy, down to late in the last war, refused to use it, not being willing to diminish the usual charge; and in the campaign in Flanders, such powder, from its superior power of resisting moisture, was, on one occasion at least, the only gunpowder that was fit for use. Analogous examples of recent date might be adduced, but those of bygone times are preferable, because bearing no allusion to persons of the present day.

tending to the diminution of dockyard expenses; while at the same time such remuneration would not hold up a precedent whereon claims for compensation could be founded in any case where the reality of the advantage had not been previously ascertained."

Sir Samuel observed, that ' in fa our of such a mode of compensation, the greater the sum to which it might be found eventually to amount, the greater in the same proportion will be the advantage the service will derive from the invention. The expense which such a compensation would occasion to the public would be no *new* expense, but only the continuance for a short and limited time of the same rate of expense which had theretofore been looked upon as necessary, and which, unless some such invention as the one in question were to be introduced, must of course have been continued for a long and unlimited time without any prospect of its diminution."

This mode of remuneration was adopted in the case of Mr. (now Sir Isambard) Brunel. But Sir Samuel, from experience, knew that in the introduction of improvements, however perfect the invention, however detailed the instructions for carrying it into execution, more or less frequent superintendence of the inventor is usually essential to success; this was provided for in the recommendation that an allowance should be made to the inventor during so much time as he should be actually employed in directing the introduction of his invention, that allowance being to be set down as an item of capital sunk, and like that to have a per centage upon it carried to account, as one of the outgoings of the factory. In the instance of Mr. Brunel, this allowance was a guinea a day for that part of his time that was actually employed in forwarding the block-making machinery, and the per centage upon the amount of this allowance was included in the outgoings influencing the savings on which his remuneration depended. That remuneration, being a twelvemonths' savings by the manufacture of blocks in Portsmouth Yard, amounted to 16,621*l.* 8s. 10d.

A sum so large may at first sight be looked upon as excessive, but it cannot be so considered if compared to the profits obtained by private manufacturers, who on their own account have brought happy inventions into use. As to Government, besides paying that one year's savings, those derived to the public from the manufacture of blocks in Portsmouth Dockyard had, before the end of the war, amounted to no less a sum than about 100,000*l.*

In making out at the Navy-office the amount of remuneration due to Mr. Brunel, one of the frequent oversights in forming contracts came to light. Blocks and block-maker's wares it appeared had been supplied to the Navy by two different contractors, Mr. Taylor and Mr. Dunsterville, but the prices allowed to them by their respective contracts, were in the one nearly double of those in the other. It followed that at Mr. Dunsterville's prices, the savings on a certain portion of blocks, &c., would have amounted to but 6,691*l.* 7s. 4d., whereas at Mr. Taylor's prices, the savings on the same quantities of the same articles would have been no less than 12,742*l.* 8s. 2d.; such dissimilarity in contract prices, though then officially exhibited by Sir Samuel, does not seem to be corrected at the present day, for at p. 978 of the "Report, &c., of the Committee on Navy Estimates," 1848, it appears that the contract price for coals delivered at the dockyard at Portsmouth was 16s. 3d. per ton, but coals delivered in the same harbour for the marine barracks and infirmaries was contracted for at a much higher price, of no less than 22s. 2d. per ton. Yet this great difference seems to have escaped the notice of that committee, as it must have done the naval authorities. Such incongruities unfortunately deter many persons who would otherwise tender for naval supplies; since differences so great and glaring are by the public often attributed to favouritism. However that might have been in regard to Taylor and Dunsterville, when this discrepance appeared, Sir Samuel thought it incumbent on him to enter himself into minute details, in order to ascertain what the fair amount of savings really were.* Several

* The three manufacturing establishments in Portsmouth Dockyard, the metal mills, the wood mills, and the millwrights, were, from the first, placed under the sole direction of Sir Samuel, and in such manner, that to near the end of 1812 the management of them was as entirely confided to him as if he had carried them on for his own private emolument. He sought to make them models

of the identical machines that he had invented, and had in use at his brother's house in the year 1794, had subsequently been put up in the wood mills at Portsmouth, and were used in the sawing of wood for blocks ready for Mr. Brunel's shaping-machines, but it having been difficult to distinguish the amount of savings made by the Bentham machines, he, for this and other reasons stated in his letter to the Admiralty, May, 1813, finally determined on recommending that the savings resulting from the whole manufacture of blocks should be awarded to Mr. Brunel as his remuneration; but it would rarely happen that the individual called upon to calculate savings would himself have been a contributor to them.

This principle on which compensation may be grounded is in several instances applicable to private concerns—it often occurs in them that some one in an inferior station contrives improvements in the processes or machinery; in such cases, without calculating with minute accuracy the exact amount of savings, an approximate estimation of them might easily be made—the amount of them for a definite time would be both a more equitable reward to the man, and more advantageous to the master, than that of either making a present of a sum of money incommensurate with the benefit, or of promoting the inventor, as is often done, to a higher station, for which perhaps he might not be qualified, notwithstanding his inventive genius. But these remarks are, of course, not considered as applicable to inventions of a superior order, such as would justify the obtainment of a patent, or at least the benefit of registration.

Still it remains for some superior mind to devise the means by which architectural and engineering talents could be adequately rewarded without prejudice to the employer. Architects and civil engineers have necessarily had large sums expended on their education, they have consumed much time in study, they must besides possess the endowments of taste and of inventive genius, and they should habitually combine in their designs efficiency with economy—a rare assemblage of requirements, and worthy of high reward; yet how seldom would a thousand pounds or two be considered but as a fair compensation for an approved design? and so long as a man fails to receive by open means a reasonable remuneration for his time and skill, it must be feared that they will continue to be paid for, and over-paid fcr, in some such mischievous way as a per centage to architects on expenditure, and by a profit on machinery to civil engineers.

M. S. B.

of the economy and order with which he felt assured manufactories on Government account might be carried on; he especially insisted on the need of keeping accounts, and had them kept in those establishments, so as to exhibit the real and total cost of every article produced; and further, he asserted that accounts so kept should habitually be put to use, by bringing to the view of the superior authorities, and ultimately to Parliament, comparative, though abstracted, statements of the cost of articles obtained by different means, and under different circumstances. He was the first to show, which he repeatedly did, officially, that the whole of the civil business of the Naval Department was no other than a great manufacturing and commercial concern, and that to carry it on judiciously, the same principles should be adhered to as those by which private manufactories are guided. The heads of the items on which Mr. Brunel's remuneration was calculated may be seen in "Financial Reform Scrutinized," published by Hatchard, 1830—and they will show that several real expenses are there brought to account which never entered into the usual accounts of naval expenditures. The profits by the metal mills had, before his office was abolished, paid off the capital, with compound interest on it, that had been sunk in their erection, and was then working at a profit of no less than 40,964*l.* 12*s.* 8*d.* per annum.

LAW OF PATENTS.—REPORT OF THE COMMITTEE ON THE SIGNET AND PRIVY SEAL OFFICES.

Extracts from Minutes of Evidence.

(Continued from page 189.)

Thomas Webster, Esq., Examined:

It has been represented to the Committee that the common practice with regard to Scotch and Irish inventions is for a person to apply first for an English patent. Investigation then takes place before the English Crown lawyers, and, if the patent be granted, application is often subsequently made for a Scotch or Irish patent. And it has been stated that the investigation which takes place before the Lord Advocate, or before the Irish Attorney-General, is not of a very strict character, and that they are a good deal influenced by the previous investigation in England. Is that consistent with your knowledge?—Yes; I have no doubt that it is so, and for this reason, the Lord Advocate is very often in London on official business. It is much easier machinery, and is more easy here, probably, the getting a patent,

than in Scotland. But I take it the principal reason is this; that this is the great seat of manufactures compared with Scotland, and that five to two are more likely to be profitable in this country than in Scotland. In fact, having a patent here, you can supply Scotland from this place. I think that is the reason, and not any advantages of the kind you have adverted to; because, why should the Attorney-General's report be any better than the Lord Advocate's? The end is to get the patent. If you have a report here, then, inasmuch as that is a sort of decision that the patent is new in all the realms, the Lord Advocate will most likely say, "Well, if it is not new, you must take it upon your own risk." There has been one decision upon that. I know that the practice introduces this grievance, of persons who have failed before the Attorney-General, going and entering a caveat before the Lord Advocate, leading to further litigation, and stopping the patent of the inventor. If the Committee inquire into it, they will find that there has been considerable collision in respect to the electric telegraph, between various applicants before the Attorney-General here and before the Lord Advocate in Scotland.

In the case of a patent for one country having currency for the three, you would propose, of course, that the patent in each country should only be taken out by parties having an interest in that country, not by strangers. That is, you would not let a man from Ireland or England take out a patent in Scotland?—I certainly would. The circumstance which leads a man to prefer a Scotch or Irish patent to the English, can only be that from the seat of the manufacture he thinks he can supply the country with the manufactured article from that spot. In the case of Whittock's patent, the profits came entirely from Scotland. In the case of the hot-blast, the person might have said, "It is not worth my while to take out a patent for England, I will limit myself to Scotland."

Has not the Attorney-General much more experience in patent cases than the Crown lawyers in either of the two other countries?—Much more.

The number of applications for English patents is far greater than those for Scotch or Irish?—Yes, far greater. The number of cases tried here is much greater.

For that reason, do not you think that the English Attorney-General is likely to be a better tribunal for deciding upon patent cases than the Lord-Advocate or the Attorney-General for Ireland?—No, I think not. There is no doubt that the Attorney-General has more practice; there are many more patent cases here, and therefore he may be presumed to have more practice; but then he has a great deal more to do. I think that Scotchmen are almost invariably more generally educated than English lawyers, and therefore you are more likely to have a combination of scientific knowledge, which is desirable. Therefore, putting individual against individual, I should say that the Scotch lawyer is quite as likely to give a proper decision on matters of patents as the English lawyer. It is true that there is a great deal more patent business in this country, but the Attorney-General is much more engaged.

In point of fact, I suppose the Attorney-General himself, and the Lord Advocate, are in every great patent case that occurs?—Yes.

All questions of inventions and patents in Scotland are tried in the Scotch courts. The hot-blast case was first tried in the Scotch courts, was it not?—The first trial was here. Mr. Neilson, in fact, rather preferred trying it here; the matter is better understood. As to personal qualification, I think it is not quite a correct view that has been taken. What has the law officer to do here? He really does not act very much as a judge. He says, "There is no interference, therefore you take the patent at your own risk;" or, "There is interference, and you must come to some arrangement." He is not a judicial officer. If he were, he ought not to take briefs in patent cases. If you viewed him as acting judicially rather than ministerially, he ought not to act as he does.

In fact, the case is very little inquired into in either the one case or the other?—No.

Can it be said with any correctness that the Attorney-General, in deciding upon the grant of a new patent, is acting ministerially?—Yes, and for this reason. If it is not opposed, it goes as a matter of course. He signs the warrant; the warrant is made out, and he signs the documents as a matter of course. It is only in a case in which it is opposed that the matter comes before him; and then the utmost he does is, that he hears the parties, and says if in his opinion there is no interference, and then the patent goes as a matter of course. If there is, he says, "Well, you must settle it among yourselves, or I cannot grant you the patent."

In case of opposition, does not the Attorney-General act judicially in the strictest sense of the word?—No, I think he does not. His course is this. If there is an interference to that extent he acts judicially, because he pronounces an opinion; therefore, there being an interference, the patent

must not go unless the parties can agree; and therefore the result of that decision of there being interference is, that the parties must come together, or else no patent is granted. That is a case in which there are two rival patentees. Suppose the opposition to be as between two patentees both applying for patents; if he says, "There is no interference," both patents go; if there is, only one patent is granted, according to the arrangement the parties may make between themselves. Now in the case in which the ground of application is that the invention is old, he certainly does not act judicially, because in the majority of cases he says, "Well, if it is old, then there is no harm in granting the patent; you have your remedy. I shall preclude the party for ever if I do not grant it." I do not think that he acts judicially at all in that case.

When you say that, you mean that as far as possible he avoids the necessity of coming to a distinct decision?—Yes, which will preclude the rights of parties.

Comparing the English Attorney-General with the Scotch Lord Advocate, as regards their competency, your views seem to be that the greater experience of the English Attorney-General is compensated by the greater command of time by the Lord Advocate, and his more general familiarity with scientific questions; so that the two might be considered on an equality?—One ought not perhaps to express an opinion in that way. Having seen a great deal of the law-officers of this country, I know that they are so harassed and occupied, that I wonder the business is done as well as it is. It is a miracle to me how the present Attorney-General does manage to get through matters of this sort. I put it upon this footing; if you require a party to state on paper what his invention is, and another party to state on what grounds he opposes, you really reduce it to a matter of simple comparison that almost any person can understand.

. . . .

Do you think this system would be objectionable, that it should be competent to the Crown to grant a patent to be valid for the three kingdoms upon the report of the English Attorney or Solicitor-General; and that it should be also competent to the Crown to grant a patent that should be valid for Scotland only upon the report of the Lord Advocate, and similarly with regard to Ireland?—I do not see why it should not be competent for the Crown to grant a patent for the three countries, on the report either of the English Attorney or Solicitor-General, or the Lord Advocate, or the Attorney or Solicitor-General, for Ireland, and, *à fortiori*, I see no objection to the Crown granting a patent to a limited extent. Why is there to be any preference given to the report of the Attorney-General over the Lord Advocate's or the Attorney-General for Ireland. If a party says, "I live in Dublin, or in Edinburgh, I do not want to go to town," why should he not obtain his patent for the three kingdoms on the report of the law-officer on the spot, rather than the law-officer at a distance?

. . . .

After the Patent Bill is prepared, the patent is forwarded through the Signet and Privy Seal-offices?—Yes,

The part of the proceeding is regulated by the statute of Henry VIII., is it not? —Yes, entirely, and which was passed for the purpose of creating fees: — the 27th of Henry VIII., Chapter 11, which requires that every patent should be brought to the clerks of the Signet and Privy Seal, and go through certain stages. Up to that stage, I believe, it is a matter of practice which the particular offices could control. From that stage it is a matter regulated by an Act of Parliament passed simply for the sake of the fees, and is a very great hardship. If you have two names, you have the expense very much increased; three and so on without any corresponding benefit or protection; in fact, the offices are absolutely useless.

Is it not stated in the preamble to that statute that the object is to increase the fees to the clerk at the Signet and the clerk at the Privy Seal-office?—Yes; it states that the clerks of the Signet and Privy Seal give their daily attendance for great and weighty affairs, and have no fees "other than cometh and groweth of the said Signet and Privy Seal." And that statute was passed simply as a means of paying the clerks by requiring every grant to pass through their hands. They receive fees which are not specified on those grants.

Do not you apprehend that that statute had mainly reference to other grants than grants of patents for new inventions?—I should think, at that time, that a patent for an invention was a thing hardly known. I am not aware of any patent for an invention of an earlier date than about the 44th of Elizabeth, and this was a statute which was passed some 50 years before that time, therefore, I take it that at that time patents for inventions were things not known.

The principal statute which regulates patents for inventions is the statute of James I., is it not?—Patents exist now entirely by virtue of that statute, but it contains nothing as regards the practice. It merely declared all monopolies to be void, excepting the grants of Letters Patent for new manufac-

tures for 14 years to the true and first inventor thereof. That statute merely defines what was the law of patents, and has nothing to do with the practice; that is wholly regulated by the statute of the 27th of Henry VIII., and the 18th of Henry VI.

Do you see any advantage in carrying a patent for a new invention through the Signet and Privy Seal-offices?—None; but a very great disadvantage both as regards delay and expense; and in the case of the absence of the Lord Privy Seal, it is a source of very great expense. I have been told that, at the time when the Lord Privy Seal was in attendance on Her Majesty in Scotland, it had put one of my clients to 22*l*. additional expense to get a patent through the Privy Seal. It occasions delay; and I need not say, that delay is a matter of serious consequence, inasmuch as the patent does not date till the date of the Privy Seal. It is a matter of very great importance; and that will illustrate the principle of the statute of the 18th of Henry VI., which requires that a patent shall not be dated previously to the date of the Privy Seal: that was by reason of their getting offices and lands' grants dated as far back as possible: and, therefore, the statute says, that the patent shall not be dated of a prior date to that; it might be dated at a subsequent date. It is clear that the practice as it exists now, was a practice established wholly with reference to lands and offices, and entirely without regard to this mass of property that has grown up.

Patents for new inventions have been subjected to a process which was devised for totally different purposes?—Yes, every stage you come to shows that. The form of the Letters Patent shows that it has been moulded from time to time with reference to grants of lands and offices.

It appears that copies of the patents are made out in the Patent Bill-office, and transmitted to the subsequent offices, in order that certain formal additions may be made to them, and the proper seals attached; are you aware of any advantage which arises from the system of transcripts and the passage of the patent through the different offices?—No, I am not aware of any advantage whatever, but of a very great disadvantage, which I will illustrate very practically in the case of Nickle's Patent, in which the word "recovering" was put for "covering." If you happen to have a mistake at any one stage, inasmuch as these three transcripts are made in one office, that is repeated without a chance of correction; there being no supervision, nor any advantage of that kind. All that could be required would be to have one record kept of each stage; whereas, here you have three records, two of which might be dispensed with. There could be no reason why the Queen's Bill should not become the Privy Seal Bill, and be the record upon which the patent was granted.

Does not a multiplicity of transcripts increase the chances of error?—Yes, and expense of necessity. I never heard any suggestion of any advantage to be derived from the three Bills—the Queen's Bill, the Signet Bill, and the Privy Seal Bill; one is necessary.

One must be retained as a record?—Yes.

Do you think it is necessary that the grant of a patent should be so long an instrument as it is at present?—I do not think it is; but I do not think that that is of any very great consequence.

Are there not certain clauses which are in each, which stand in every patent?—Yes; but I do not think that could be shortened much. You must recite the petition; then there is the granting and the prohibitory part, and certain provisoes which are clearly inoperative, and which, as the law now stands, ought not to exist; they are contrary to law. In the case of Brown *v.* Annandale, Lord Lyndhurst suggests that a patent containing provisoes of the form that are usually inserted, inasmuch as such provisoes are contrary to law, might be repealed by *scire facias* upon that very ground.

Is there any necessity for the clause commanding the justices not to molest patentees?—None whatever; it is altogether rubbish.

The first proviso is, "that if the grant be contrary to law, the patent may be repealed." Is there any necessity for an express declaration to that effect? might not a general enactment suffice?—If it be contrary to law, if it be not a new invention, it is not the subject of a grant, and therefore falls to the ground, not being within the exception in the Statute of Monopolies. That raises the question as to the mode of repealing patents. The proviso is in this shape: "Provided always, and these our Letters Patent are and shall be upon this condition, that if at any time during the said term hereby granted it shall be made to appear to us, our heirs or successors, or any six or more of our or their Privy Council, that this our grant is contrary to law." Now, I have always thought that the proceedings by *scire facias* for repealing patents were not the proper ones, and that the Privy Council was the tribunal which ought to be applied to under this proviso. It is quite obvious that this is a proviso introduced to enable the Privy Council, or to enable the Lords, under the Signet or the Privy Seal, to exercise a

jurisdiction in addition to the common law jurisdiction which they had. Though I believe this not to have been acted upon, yet there is no doubt that, in earlier times, the patents were dealt with in a summary manner by the Star Chamber and by the Privy Council, and in various ways. There is more in that proviso than the mere declaration at common law. The Crown, of course, or the Attorney-General, introduces any proviso that he thinks necessary for the patentee or the Crown.

With regard to all of the permanent provisos in a patent, would it not be practicable to have a set of general enactments upon the subject, and to frame the patent in a very brief form?—You might leave this out, there is no good in it. As the proviso stands, it grants a jurisdiction which the Privy Council would not have at common law. Probably it is preserving to them the jurisdiction that they had as to granting common lands.

If it were desirable to preserve that jurisdiction, might it not be done by enactment?—It might certainly; no doubt about it.

Would it not be the most convenient mode of doing it?—It is of no use keeping this proviso as it is, because it has not been acted upon. I am not prepared to say that the Privy Council would not be a much better tribunal for the repeal of patents than the present one; for nothing can be more harassing, or expensive, or vexatious, both to the patentees and to prosecutors, than the present proceedings by *scire facias*. The Master of the Rolls and the Attorney-General, in their Petty Bag-office Bill, have done something to mend matters; but it is a very harassing proceeding, and one that ought not to be tolerated. My observation upon this proviso is, that this is a proviso that gives to the Privy Council, or Lords of the Signet and Privy Seal, the power of repealing a patent; and I say that, before that is struck out altogether, it would be as well to consider whether the object of that is not good, and whether some other mode of dealing with the repeal of a patent had not better be substituted. The next proviso is, "Not to interfere with any Letters Patent previously granted." That is wholly inoperative as regards Letters Patent for inventions. There can be no earthly meaning in it, except by referring it to preserving grants of offices and lands; because if an invention is the subject of a prior patent, the second patentee is not the true and first inventor, and the invention is not new; therefore that is wholly without any meaning.

It is inapplicable to the grant of a patent for a new invention?—Clearly so. That has been preserved from the original grants of lands and offices.

The next proviso is that, if the patent becomes vested in more than twelve persons, the patent is to become void?—That is a very serious question occasionally, and that is a proviso which I should not be disposed to omit, for this reason, it is got over by granting a licence to a Company. It was introduced, in accordance with the principles of the statute called the Bubble Act, to prevent a too extended copartnership in a patent, and I think it is good in principle. It not unfrequently happens that a patent is worth nothing, excepting to have a legal proceeding upon, and to harass parties; for as you facilitate the introduction of capital, and a larger number of parties become interested in patents, you give rise to litigation. I think that is a proviso that ought not to be excluded without full consideration.

Might not a proviso be made the subject of specific legislation, so as to avoid the necessity of repeating it in each individual grant of the patent?—In some cases you might wish to exclude that altogether. In some cases, I think, it would be proper, upon application to the Attorney-General, to allow more than the prescribed number of partners.

In that case, the power might be reserved to the Crown by special declaration?—Yes.

Is that clause ever omitted?—No. It used to be five, it has latterly been extended to twelve. I think that is a special case; I do not object to it. I am not an advocate for general legislation in cases where you must sometimes have the course of legislation interfered with by a special suspension of its power. As to "the specification to be enrolled," there is no objection to that. The next, as to "articles required for the service of the Crown to be supplied," is a most improper proviso. It has been used, and has, very improperly, at times, been held as a threat over patentees, and I think ought not to stand.

Does the Crown ever exercise that right?—It has been threatened, and is a bugbear and a prejudice to patentees certainly. It gave rise to a case of mandamus; a case where the Lords of the Admiralty chose to use a patent anchor, and would not pay for it. The Court of Queen's Bench would not grant a mandamus to compel them to do it. I do not think that the Crown would then use it, but there is the power to use it, and it is an embarrassing proviso. I think that matters ought not to stand as they do under this proviso, as being neither right to the Crown nor to the public.

You would omit that proviso, and make no general provision upon the subject?—None whatever.

There is a declaration at the end, that the patent shall be valid, notwithstanding that the description of the invention may not be full?—That is a senseless one, as applied to patents for inventions. It no doubt had reference to the difficulty in describing abuttals in grants of lands, and other particulars in grants of perquisites and grants of offices. There is no meaning in it, excepting, I think, that it might as well stand as a declaration that courts of justice were to be liberal in construing a grant of a patent, if there were any ambiguity in the terms of the title; and courts of justice do adopt that principle.

Are not the principles of the construction of patents now settled by the Courts, without reference to any general declaration of this sort?—Yes; but as a general rule the grant is taken most strictly against the grantor; but that would not apply to the case of the Crown; excepting for some express declaration, I do not think it is of much consequence. The last words, "notwithstanding the not full and certain describing the nature or quality of the said invention, or of the materials thereunto conducing and belonging," is a senseless piece of rubbish.

Does not all increase in the length of a patent necessarily lead to an increase of expense, and also multiply the chances of error?—Yes, no doubt; but still the increase of expense for mere copying is not very considerable, if there is any advantage in retaining any of those parts, as compared to other expenses, of stamps, and expenses in opposition.

With regard to the fees taken in the different offices, the question is to be considered under two heads; first, as to the policy of the mode of imposing a certain tax upon grants of patents for new inventions; and, secondly, as to its amount?—Yes.

Looking first to the mode of raising the tax, do you think it is preferable to raise it by a succession of fees, or to make one charge by way of stamp duty?—I think it is desirable to raise it by a succession of fees, say two or three fees; but I think that the way in which it is raised at present, by a multiplicity of fees, is most oppressive and inconvenient, and leads to great incidental expenses, where you have such a number to pay. It is found that there will always be some additional fees, by way of perquisites, that come in the end to a very great tax, beyond the legitimate fees of the offices and such as are returned to Parliament. Without reference to these, there must be, where you have such a multiplicity of them, a very great number of additional fees that add to the sum-total very much. But I think it would be very advisable, or at least not objectionable, to have the fees paid at three stages, say, the Home-office, the Patent Bill-office, or the Attorney-General's-office, and the Great Seal; for this reason: parties very often go to a certain stage, and then stop; and it is quite as well to leave this matter in the control of the individual. A man begins his patent, wants his protection, and finds it not worth his while to go on. I think it would be much better, and more approved of, that you should pay the fees at twice or three times than at once—in one sum. But nothing can be more inconvenient than the present system of requiring a person to pay at so many different offices.

Would it not be necessary that there should be a different scale of fees in the case of patents being opposed and those not being opposed?—No, I think not: I think that the expenses of opposition should be quite distinct from the expenses of the patent.

Would it not be necessary that the Attorney-General should have a fee in case of opposition, which fee would not be payable in case of no opposition?—Certainly, I think that. I think the machinery of opposition to patents should not be detached entirely from the patents that proceeded as a matter of course. I think it is worth considering whether looking at the fees as a tax which inventors may very well pay for their monopoly as a source of revenue, a patentee might not be required to pay a sum every five years for the continuance of the monopoly. It would be very desirable if our practice in law could be assimilated in some respects to the French, that if a patent is not worked it shall be thrown open to the public. I know that patents that are worthless are actually held to hang other inventions on, and keep other persons out. I opposed this session a Patent Candle Company, where they obtained a power to repeal the restrictive clause in respect of thirty-nine or forty-nine patents, I am not sure which. We said, "This is a most monstrous monopoly." I certainly felt, and still feel, that it ought never to have been tolerated. It was admitted that a great number of those patents were practically useless; the course of invention had been so rapid that they were worth nothing, commercially speaking, for the sake of manufacturing the article, but of extreme value in the hands of a powerful Company, as tending to keep the whole of the manufacture in the hands of one party. I think it is worth considering, on the subject of fees, whether it would not be desirable to reduce the payments,—for instance, a patent now for the three countries costs 350*l.*, consequently you have very few for

Scotland, and hardly any for Ireland,—whether a patent should not be reduced to 150*l.*, and whether some payment might not be required from patentees at the end of seven years if they liked to continue their patents.

Is not that objection which you state rather an objection to the grant of patents generally than to the mode of payment; that is to say, that they tend to discourage new inventions?—No, I think not. I think there is no sounder policy than granting patents, because new inventions require cherishing for a certain time. The state of things is this, where you have the progress of invention rapid, take the electric telegraph for instance, or the introduction of cocoa nut and palm oil in the manufacture of candles. You have the old patents worth nothing as patents to be worked as a useful manufacture, but yet they are useful to preserve the monopoly in the hands of the parties who hold them.

Those are patents that you propose, not being worked, to throw open?—Yes, or if kept, I would make people pay for keeping them. The state should get something.

You say that the progress of invention has gone round those patents, and that the invention would have been still more advantageous if it could have gone straight through those patents, and availed itself of them in its progress; that the process would be more advantageous if it could combine all those patents?—Yes.

Then they would be taking the benefit of the old inventions?—Yes; but it arises in this way. It may be worth the while of large capitalists or a company to buy up every patent that exists relating to electric telegraphs or to candles merely for this purpose, saying, "If you make any improvement, you shall not work it without making terms with us, because you are touching upon a patent which though useless to work may be sufficient to hang a Chancery suit upon." We know perfectly well that the terror of litigation is sufficient to check the progress of an invention. In the case of Morgan *v.* Seaward, which is a leading case upon that point, the Court says, "A grant of a monopoly for an invention which is altogether useless, may well be considered as 'mischievous to the State, to the hurt of trade, or generally inconvenient,' and within the meaning of the statute of James I., which requires, as a condition of the grant, that it should not be so, for no addition or improvement of such an invention could be made by any one during the continuance of the monopoly, without obliging the person making use of it to purchase the useless invention." Now the Committee must observe, that although the invention is altogether useless now, it might have been very useful five years ago, and therefore if that proviso preventing more than 12 parties being interested in a patent is to be repealed, or parties are to be allowed to obtain an Act to repeal it wholesale, I think it is necessary that some steps should be taken to allow the public to use or improve upon inventions that have been superseded by others and become useless, and are in such a position that they might be repealed by *scire facias*, if it was worth anybody's while to do it.

Supposing the number of the fees was considerably diminished, and that they were payable only at two or three stages in the progress of the patent, according to your recommendation, do you think it desirable that there should be one gross sum, in the nature of a stamp-duty, payable upon the patent when it is sealed, or that that payment should be annual, according to the French system?—I think I would combine the two; but I have not much considered that. Nothing can be worse than the present system; and I think if the price is to be kept up, that it would not do to require it to be paid in one gross sum, for this reason, that persons might like to have the advantage of going to a certain stage, and if so, they ought to pay for that. If an invention becomes abandoned before the Great Seal, he has that protection, and he ought to pay for it up to that stage. Therefore I should not recommend one gross sum by way of stamp-duty, though the cheapest to collect, especially as you must have some intermediate offices; but I would press upon the attention of the Committee the policy of annual payments. I think it is a very good principle indeed. An English patent now costs about 105*l.*; a patent for the three kingdoms costs about 350*l.*; a patent for Scotland 80*l.*; and a patent for Ireland 150*l.*; a most curious difference of charge. I think 350*l.* for the three countries is far too large. What is the reason that you have ten times the number of patents for England than you have for Ireland, and five times the number for England than you have for Scotland? Is it because it is not worth people's while, in a commercial point of view, to go to the expense to obtain a patent for the three countries. If you reduced a patent to 150*l.* for the three countries, I believe you would get more money as a matter of fees than you do now, supposing you had one patent for the three countries at 150*l.*, instead of the present system. I am not for cheap patents. I think a patent for 5*l.* is not to be tolerated; I think the embarrassment and litigation

would be frightful. I know that manufacturers are now embarrassed by the number of patents; but that arises more from those old patents that are useless. I am not for cheap patents, still I think 350*l.* is too much. I see no objection to a person paying 150*l.* in the first instance, and a tax annually if he liked to continue it; or instead of annually, at certain stages. It generally requires half the term of a patent to see if it is worth anything. Then at the end of seven years you might have a second payment if the payment were kept up. There are patents for apparently very trifling things; and the Legislature cannot distinguish between inventions. You never know what an invention may be worth. More valuable patents, I believe, never existed than the patents for buttons. I take it that no patent for a steam engine ever paid, yet I know that two or three great houses in this country have taken out patents by reason of giving them a preference with the Admiralty or the Government in large contracts. The profits derived by the parties in such cases was an increased manufacturer's profit, rather than a genuine patent profit. You may lay down as a general rule that a patent requiring a large outlay of capital does not pay simply for the manufacture of that article; it may pay indirectly. You may have one or several articles in a patent for a new manufacture, and you must pay the same for one as for several, and for an unsuccessful as for a successful invention; but I think you may equalize the tax in some measure, by making a person pay in addition if he continues his patent beyond the first seven years. If the Privy Council extends a patent, I believe the same fees are payable over again; therefore you do get another tax. You have, as it were, two stages in the case of an extended patent.

Assuming that the fees upon an English patent were about 100*l.*, do you think it would be fair to extend that patent to Scotland or Ireland for a fee of 25*l.*?—Yes, I think it would. I may say that at a large meeting of patentees it was viewed very much in that way. They said that they thought 150*l.* a very good sum for the three kingdoms.

You agree, as a matter of public policy, that the State should not grant monopolies of new inventions upon very cheap terms? I do, and for this reason: it is of less importance that they should be granted upon cheap terms now than it used to be, because the connexion of inventors and capitalists is so much closer. Capitalists are constantly looking after patent property. I do not think it very often happens that there is a useful invention that you do not find some capitalist to take it up. If you were to examine persons from Lancashire (and that is the great storehouse of patents), you would find that they are averse to cheap patents, though there are some remarkable exceptions.

Setting aside the question of revenue, do not you think it desirable on public grounds, that a tax of a certain amount should be imposed on the grant of new patents?—Yes.

If a proportion of that tax were levied by annual or other periodical payments, the regulation probably would be that if the payment were not made, the patent would cease to be valid?—Yes.

Under those circumstances useless patents would naturally expire, because it may be presumed that the owners would cease to pay the tax upon them?—Yes.

Would not that provide for the gradual extinction of useless patents?—Yes.

Does not that appear to you to be a recommendation of the mode of levying the tax by periodical payments?—Decidedly so. But I would not make the periodical payment more than once or twice at the outside. A patentee ought not to be called upon to say whether he would continue or abandon his right too frequently. As a general rule, it takes the patentee at least the first half of his term to get the patent introduced, except in some very few cases, as where a manufacturer may have patented an article of great consumption, as a button; but to take the useful inventions generally, in cases that have come before the Privy Council, as reported in my volume of reports, it will be found that the general experience is, that the patents do not begin to be productive till after the eighth or ninth year of the term, and therefore you must not do anything that would embarrass a person within the first seven years by requiring him to pay something or to abandon his right.

It is also of some consequence that a considerable payment should be made upon the taking out of a patent?—Certainly. But so far as my own opinion goes, which is not worth much, excepting that I have conversed with a great number of persons upon the subject, I do not think 150*l.* is at all too much for the three countries as the first payment. I think you will find that if the opinions of inventors generally in Lancashire were canvassed upon that point, they would concur in that opinion.

Subject to periodical calls afterwards?—Yes, up to 50*l.*

Do you think the first term for fourteen years would be too long? No, I think not. Very few patents, indeed the majority of patents, do not pay their ex-

penses; I do not believe more than one in five. It is useful in various ways that patents should be granted, and they should be looked upon as encouraging invention, and as carrying on the arts and manufactures of the country.

After it is proved to be useless, may it not be converted into a means of vexation to others in the manner you have described?—Unquestionably it may; but then you see, if a party were obliged to pay a certain sum, if he continued the whole length of his term, and were to lose his patent right in respect of it if he did not pay it, he would not continue a useless patent.

If, at the end of seven years, a patent proved to be useless, would there be any hardship in affording a motive to abandon it?—None whatever. You might return a sum of money as a premium to the party who abandoned it. You must either require the party who determined to take a second to pay a second sum, or give him a premium to abandon it. I think this a matter hardly to be decided upon without further consideration.

Is it competent to any party to oppose a patent either at the Signet-office or at the Office of the Lord Privy Seal?—I believe, in point of law, it may be considered competent. I presume that the Lord Privy Seal or chief officer of the Signet is supposed to exercise some ministerial act in putting the seal to it; but, I believe, it is entirely an abandoned practice. All the proceedings in the Signet and Privy Seal are practically defunct.

When a patent reaches the Great Seal, what proceedings may there take place?—When a patent reaches the Great Seal, there may be a caveat there.

Is that caveat entered at the Patent-office of the Great Seal?—That caveat, I believe, is entered at the Patent-office of the Great Seal, and then there is a petition presented, the caveat being entered, to the Chancellor to seal the patent, and the practice is to refer it back to the Attorney-General to advise the Lord Chancellor on the matter of that petition. It becomes very much a rehearing before the Attorney-General upon new facts; but the Lord Chancellor is not bound by the decision of the Attorney-General; he calls him in as *amicus curiæ*. In the recent case of Cutler's patent, the present Lord Chancellor did not adopt the decision of the Attorney-General, but sealed the patent, notwithstanding that the Attorney-General recommended that it should not be sealed.

In every case of opposition before the Great Seal, reference would be made in the first instance to the Attorney-General?—Yes, in every case. But that has grown up as a recent practice. It was introduced by Lord Brougham in the case of Alcock's patent, where he is represented as saying that he sent it back for the assistance of the Attorney-General to assist the conscience of the Court, to see whether the sealing should go. That was the way in which it was introduced, and, I believe, it has been adhered to generally to the present time. There have been several oppositions lately at the Great Seal, but several of them under rather suspicious circumstances. They were cases pretty much of the same kind; the parties made opposition before the Attorney-General, and endeavoured to make bargains and to drive hard terms, and rather as a means of making a commercial arrangement than opposition of any *bonâ fide* character.

(*To be continued in our next.*)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 30TH OF AUGUST, 1849.

BENJAMIN BIRAM, of Wentworth, York, gentleman. *For improvements in miners' lamps.* Patent dated February 28, 1849.

The object of Mr. Biram in the improvements which form the subject of his present patent, is to increase the light obtainable from those miners' lamps which are constructed on the principle of what is called "The Davy Lamp," and to afford better protection to the flame from currents of air. We shall give an illustrated description of a lamp embodying these improvements in our next, and, in the meanwhile, subjoin Mr. Biram's statement of his claims.

Claims.—I declare that the improvements in miners' lamps which I claim as embraced in my said invention, are—

1. The combination of a metallic reflector with the burner.

2. The first cover (or door), composed partly of talc and partly of wire gauze, or wholly of talc.

3. The combination of the parts, whereby all access to the interior of the lamp is prevented, except by means of a key.

4. The employment of a pricker to raise, depress, or trim the wick, revolving on an universal joint, and moving to and fro in the ball of the joint. And,

5. The combination of a wire gauze aperture, for the admission of air to the lamp, with a flexible tube leading from it to the open air.

OBED BLAKE, of the Thames Plate Glass Company, Blackwall, Middlesex, manager. *For certain improvements in the process or processes of manufacturing and finishing plates, sheets, or panes of glass.* Patent dated February 28, 1849.

The improved machinery described in this specification is for the polishing of sheets or plates of glass, and has two main features claiming novelty. The first is the compound motion given to the upper or rubbing sheet of glass; the second is the manner of attaching the upper plate of glass to the moveable portion of the machine.

The compound motion is obtained from three cranks placed on upright revolving spindles, and which are connected by rods to a plate of metal, to which the upper plate or sheet of glass is attached by the means after described. One of the cranks produces a lateral motion, the other two produce a longitudinal motion; and at the same time these two latter, by means of the throw of one crank being greater than that of the other, produce a partly rotary motion of the plate of metal, and consequently of the glass affixed to it.

The plate of glass is affixed to the plate of metal by means of atmospheric pressure. The metal is pierced with holes, over which is placed a hollow vessel, with vulcanized India-rubber edges: the air is exhausted from the hollow vessel either by the lungs or an air-pump through a stop-cock. The exhaustion of the air causes the plate of glass to adhere to the metal plate.

Claim.—The patentee claims the machinery as described, for the purposes of polishing plates, sheets, or panes of glass; but he disclaims the separate parts of which it consists.

John Hick, of Bolton-le-Moors, Lancashire, engineer, and William Hodgson Gratrix, of Salford, in the same county, engineer. *For certain improvements in steam engines, which improvements are more particularly applicable to marine engines; and also improvements in machinery or apparatus for propelling vessels.* Patent dated February 28, 1849.

The first of these improvements relates to the construction of the steam engine, the chief features of which are as follows:—The cylinder, which oscillates, is laid horizontally; a piston-rod passes out at each end of the cylinder; these rods are connected to cranks; the shafts carrying these cranks have other cranks upon them, by which, with connecting rods, the power is transmitted to the main propelling shaft of a steam-boat.

The second improvement is in the construction of a screw propeller, the chief feature of novelty being that each of the different screw-blades is composed of two portions—the inner portion, that nearest to the shaft, stands nearly perpendicular to the axial line of the shaft; the outer portion is inclined at an angle of 140° with the inner portion of the screw-blade.

Claims.—1. The arrangements and disposition of the steam engine above described.

2. The construction of screw propellers with two inclinations of the blades

Henry Crosley, of the firm of Henry Crosley, Son, and Galsworthy, of Emerson-street, Surrey, engineers and coppersmiths. *For certain improved modes or methods of, and apparatus for heating and lighting, for drying substances, and for employing air in a warm and cold state for manufacturing purposes.* Patent dated February 28, 1849.

As this specification is of a comprehensive and voluminous character, and as the claims could not be well understood without some descriptive matter, we intend giving a full description in our next number.

Augustus Clemence Kurtz, of Wandsworth, Surrey, gentleman. *For certain improvements in looms for weaving.* Patent dated February 28, 1849.

One of these improvements is to enable perforated paper to be used instead of cards in Jacquard looms. The arrangements are nearly, if not exactly, the same as those patented by Mr. Mackenzie, and described in this Journal, vol. L., p. 138.

A second improvement is in the machine for punching the paper; which, although very simple of its kind, is yet too complicated to be understood without an engraving.

Claims.—1. "The plate, *t*, in fig. 2, sheet *f*," of the drawings annexed to the specification; (there is, however, no such plate *t*, shown in fig. 2).

2. The different parts of the machinery shown in the drawings.

3. The machinery for punching the paper.

Joseph Barker, of Esher-street, Kennington, artist. *For an improved method of constructing umbrellas and parasols.* Patent dated February 28, 1849.

The improvements in the articles named in the title refer to the formation of the ribs, the manner in which they are joined to the stick, and the manner of expanding or closing up the umbrella or parasol. The ribs terminate at their upper ends in thin elastic pieces, which are connected to them by rivets, or other fastening; the other, or free ends of the elastic prolongations of the ribs are secured to a wooden ferrule, fixed on the stick of the umbrella by means of a metal ring, which, being driven on over the elastic pieces, hoops them down upon the wooden ferrule. The ends of the ribs are further attached to the stick by means of a metal ring, of the usual form employed for that purpose. The ribs are expanded and

closed by means of a rod which slides within the stick, which is connected at its upper end to the ring to which the ribs are attached; this rod is furnished at its lower end with a knob to be laid hold of by the hand.

Claim.— The arrangements described in the construction of umbrellas and parasols.

GEORGE FERGUSSON WILSON, of Belmont, Vauxhall, gentleman. *For improvements in separating the more liquid from the more solid parts of fatty and oily matters, and in separating fatty and oily matters from foreign matters.* Patent dated February 28, 1849.

These improvements consist of the application of the hydro-extractor of Messrs. Manlove and Alliott (Seyrig's) to the extraction of the more liquid portions of fats, and also of oils from the expressed or broken nuts containing those oils. The interior surface of the containing cylinder of the extractor is covered with a filtering medium, the patentee preferring for this purpose twilled cotton cloth. The fatty matters are put into a bag the length of which is just sufficient to reach round the cylinder; this arrangement facilitates the removal of the thicker portions of the matters left in the machine.

Claim.—The employment of the hydro-extractor for the purpose of separating the liquid from the solid portions of fatty matters.

PIERRE ISIDOR DAVID, of Paris, France. *For improvements in bleaching cotton.* Patent dated February 28, 1849.

These improvements relate to a mode of bleaching cotton by means of chlorine gas The oxide of manganese and the acid are put into a retort, over a sand bath; the gas generated is conveyed by pipes through a series of glass vessels, in which it gets washed and purified; a pipe, leading from the last of the glass vessels, conveys the gas into the bottom of a wooden chamber. The materials to be bleached, either cotton in its raw state, or spun or woven into goods, are laid upon a perforated leaden shelf or partition of the box; the gas is thus made to pass up through the cotton or goods, and thereby bleaches them.

A fan, or blowing-machine is sometimes used to facilitate the passage of the chlorine, and also to clear the chamber of gas, previous to opening it to take out the bleached articles. The chamber is provided with glass-covered openings, in order that the progress of the operation may be watched.

No claims.

PERCEVAL MOSES PARSONS, of Lewisham, Kent, civil engineer. *For certain improvements in railways, railway engines and carriages, and certain of their appurtenances.* Patent dated February 28, 1849.

The patentee claims—1. The improved railway turntable, in so far as regards the peculiar arrangements and combinations by which the moveable platform, when at rest, is supported, partly on a central pivot, and partly on moveable or temporary supports, which are forced to their bearings by means of self-acting agents, and are withdrawn when the table is required to be turned, leaving the table supported by the central pivot alone while rotating.

2. Securing the rails of railways directly to the longitudinal or cross sleepers by means of wooden trenails without the intervention of the ordinary chairs, and also encasing the heads of such trenails in thimbles or ferrules.

3. The plan of securing the rails by inserting them in recesses cut in cross sleepers and making them fast therein by keys or wedges.

4. The methods of securing the joints of rails, which are attached to the sleepers, without the aid of chairs, and which are supported by the sleeper itself immediately at the joint, by means of clamps or splices.

5. The employment in railways of switches with the tongue rails of the improved forms, whether as regards the whole or only points of the tongue rails; also securing the fixed rails into the switch chairs by means of wooden keys, where tongue rails, which are less in depth than the fixed rails, are employed.

6. The improvements in railway crossings, that is to say in so far as regards the peculiar form given to the points.

7. The forming of pairs of wheels and axles of railway engines and carriages all in one piece, or the pairs of wheels and axles all in one piece with the exception of the tyres; and also the mode of constructing railway wheels by forming the spokes out of a flange on the inside of the tyre or rim, and the mode of attaching the tyres.

8. The forming of the springs of railway engines and carriages of one or more plates of steel or other flexible material, the ends of which are rigidly attached to bearings or brackets fixed on the framing of the engines or carriages, or to the framing of the engines or carriages themselves, if of a suitable form, in such a manner that when the load or strain is applied between the two fixed ends of the springs it will cause the said springs to yield, bend, or spring, at or from the points of attachment as well as at the points where the weight or strain is applied. And

9. The mode of constructing the draw-

bars or hooks of railway engines and carriages, by which they can be screwed in or out to any required length by means of a lever at the ends of the carriage attached to them, or a nut into which they are screwed.

Amedee Francois Remond, of Birmingham. *For improvements in machinery for folding envelopes, and in the manufacture of envelopes.* Patent dated February 28, 1849.

These improvements consist in the employment of atmospheric pressure, first for feeding the cut paper into a box the size of the folded envelope; a plunger coming down upon the paper while over the mouth of the box forces down the paper, leaving the folds of the envelope between the plunger and the sides of the box; the plunger or piston is then raised up, and the sides of the box being pierced with holes, the folds of the paper are next made by a second application of the atmospheric pressure to fall under the raised plunger, the plunger is then made to descend, which completes the folding of the envelope. The pressure is produced by bellows driven by the machine, to which it is connected.

Claims.—1. The means employed for feeding-in the paper by atmospheric pressure.

2. The folding of the envelopes by means of atmospheric pressure.

Charles Jacob, of Nine Elms, Surrey, engineer. *For improvements in the manufacture of earthenware tubes or pipes.* Patent dated February 28, 1849.

The improvements have for their object the forming of a faucet or socket upon the ends of earthenware pipes, while they are being passed through a die-plate; this the patentee accomplishes by means of a socket mould, which fits upon the orifice in the dod-plate, through which the pipe is moulded; when the socket mould is filled with clay, it yields and goes along with the pipe being formed; it is held up to its place against the die-plate, or against the end of the pipe, by means of a counterpoise weight.

Claims.—The means above described for forming the sockets of earthenware pipes.

Thomas Rowlandson, of Liverpool, chemist. *For improvements in the treatment of certain mineral waters, to obtain products therefrom, and in obtaining certain metals from certain compounds containing those metals, and in obtaining other products by the use of certain compounds containing metals.* Patent dated February 28, 1849.

The first improvement is in precipitating copper from its solutions by means of alkaline, earthy or metallic sulphates, preferring such sulphates as throw down the metallic copper alone without other metallic or earthy precipitates. The second improvement is in the treatment of such ores as contain copper, silver, and gold, either singly or combined, and at the same time combined with zinc. The zinc prevents such ores being treated in the usual manner for reducing the other metals. The patentee roasts such ores in the first instance (after they have been reduced to powder), keeping them for some time at a red heat, by which the zinc is converted into sulphate and oxide of zinc, the former of which is separated by lixiviation, the latter by means of sulphuric or muriatic acid. The third improvement is in forming stannates of soda and potash, by roasting the ores of tin with carbonate of soda and carbonate of potash in a furnace; during the process the mixture is kept stirred.

The other improvements relate to the formation of sulphate of soda.

Claims.—1. The precipitating of copper from mineral waters or solutions containing copper by means of alkaline, earthy, or metallic sulphates.

2. The means of treating and separating zinc from ores of lead, copper, silver, and gold.

3. The forming of stannate of soda and stannate of potash by treating the ores of tin, or other matters containing tin, with carbonate of soda and carbonate of potash.

4. The obtaining sulphate of soda by treating bisulphate of iron and iron with common salt.

5. The obtaining sulphate of soda by treating bisulphate of iron and subsulphate of iron with common salt.

Job Cutler, of Spark Brook, near Birmingham, civil engineer. *For certain improvements in the manufacture of metal pipes or tubes.* Patent dated February 28, 1849.

The first of these improvements has relation to the application of machinery for drawing metal pipes, when formed from off the mandril upon which they have been rolled, and with much less risk of causing them to crack or break than the means now employed for that purpose. This improvement the patentee limits to such pipes as are made of alloys of metal. The metal is first cast in the form of a short pipe, and, when cleaned, is heated and put upon a mandril, and passed successively through rollers, the grooves in which diminish in size, so that the pipe is reduced in thickness and correspondingly increased in length on its passage through each successive pair of grooves. The metal out of which the pipe

is formed is hot during the whole process, so that it does not require to be taken off from the mandril and annealed until finished. To take the pipe from off the mandril, it is cross-rolled by being introduced between three rollers, so arranged that they all bear longitudinally upon the pipe. This cross-rolling causes it to become loose upon the mandril, and therefore to be easily withdrawn therefrom. A plan of loosing the mandril by means of swedges and a tilt-hammer, is also described.

The second improvement is in rolling the scabbards or sheaths of swords in a similar way to rolling pipes. The grooves are made the proper shape in the rolls, and a mandril of flat steel is employed instead of the round one used for pipes.

The third improvement has relation to the formation of rocket tubes, and consists in making them true and of an uniform thickness. This is effected by the cross-rolling process above described.

The fourth improvement is in coating pipes, for steam boiler purposes, with a coating of compound metal, giving them first a coating of tin or zinc, and then another of copper. These coatings are deposited upon the pipes by means of a galvanic arrangement.

The fifth improvement is in coating the outsides of pipes, for the conveyance of gas and fluids under ground, with metal, as last described. The inside of these pipes is covered with enamel, by any of the usual processes employed for enamelling pans and other articles made of iron; or both the outside and inside of such pipes are enamelled.

Claims.—1. The means employed for taking the mandril, by cross-rolling, from pipes formed of alloys of metals, as described.

2. The making of sword scabbards, as described

3. The making of pipes of uniform thickness by cross-rolling.

4. The coating of pipes with different metals. And

5. The coating and enamelling of pipes for sewerage and underground purposes.

Charles Andre Felix Rochaz, of New-court, St. Swithin's-lane, merchant. *For improvements in the manufacture of oxide of zinc, and in the making of paints and cements where oxide of zinc is used.* Patent dated February 28, 1849.

The first of these improvements has for its object the obtaining of a greater quantity of pure oxide from a given quantity of zinc than has been heretofore found practicable. The means employed for this purpose are, subliming the zinc, the oxide of which is gathered in chambers, in which there are suspended ranges of bands, to which the pure particles of oxide adhere, and from which they are removed from time to time as they collect. The patentee prefers making the exterior covering of the chambers for collecting the oxide, of canvas, which is wetted and found to be of advantage. The oxide which collects on the canvas covering is removed by beating on the outside.

The second improvement has for its object the employment of the coarser portions of the oxide, which are scraped from the passages and other parts of the apparatus, for mixing with lime, and when so employed as mortar, the compound forms a very hard and durable cement.

The patentee makes a durable white paint or pigment by taking twenty parts of the basis (oxide of zinc), four parts resin, two parts turpentine, and one part drying oil. This forms a very speedily drying paint.

No claims.

William Brindley, of Twickenham, papier maché manufacturer. *For improvements in the manufacture of waterproof paper.* Patent dated February 28, 1849.

The improvements consist in rendering either the long webs of paper made by the machine, or sheets of hand-made paper, waterproof, by means of oil (preferring linseed oil) with which the paper is saturated, and then subjected to a temperature of 200° or 300° Fahr. Paper thus prepared is useful for making paper hangings.

Claim.—The process above described for rendering webs or sheets of paper waterproof.

Dion de Bourcicault, of the Quadrant, Regent-street, gentleman. *For certain improvements in the mode or modes to be used for transmitting and distributing liquids and fluids for agricultural purposes and for apparatus connected therewith.* Patent dated February 28, 1849.

These improvements consist in laying main pipes along the ends of fields and other ground to be cultivated, from which a number of drains branch off, similar to those used in the process of "thorough drainage." The drains are partly filled with some substance, such as coke. The fluid or gas, where such may be employed is admitted into the main pipe from a reservoir, and finding its way along the drains is supplied to the ground by capillary attraction.

Claim.—The general arrangement for supplying fluids to ground to be cultivated.

NORTHERN CIRCUIT.—*Liverpool, Aug.* 27.

NISI PRIUS COURT.

[Before Mr. Justice Patteson.]

SELLERS *v.* DICKENSON.

This was an action brought by the plaintiff, who is a cotton-spinner at Burnley, for the infringement of a patent for the improvement of a power-loom, against the defendant, who is a power-loom manufacturer at Blackburn. The defendant pleaded the general issue, and a number of special pleas averring that the specification was bad, and that the invention was not new.

The invention claimed was a mode of applying a "break" to the fly-wheel of the power-loom, by means of which, whenever necessary, the wheel could be steadily and almost instantaneously stopped, without injury to the web or to the machinery. By the old mode, the wheel was brought to a dead stop, which, when it was revolving with rapidity, injured the web and the machinery. This improvement enabled the power-loom to be worked 25 per cent. quicker. There was also a "clutch-box" added to the loom, which was said to be an improvement, and the specification claimed the combination of the two. It was alleged that the defendant had infringed the patent by an arrangement of machinery different to the plaintiff's, but identical in principle. For the defendant it was contended that the "break" was an old invention, as also was the "clutch-box;" and that the plaintiff claimed only a new arrangement of this machinery, which the defendant had not copied, nor had he combined the "clutch-box" in his machine. A great number of witnesses were called on both sides to prove these facts.

His Lordship having summed up, the jury found a verdict for the plaintiff.

His Lordship then reserved leave to the defendant to move to enter the verdict for him if the Court above should be of opinion that the combination of the "break" and the "clutch-box" was the patent, and that the use of the "break" alone was not an infringement of it.

Mr. Martin, Q.C., Mr. Atherton, and Mr. Webster, appeared for the plaintiff; and Mr. Watson, Q.C., Mr. Crompton, and Mr. Cowling for the defendant.

LIST OF SCOTCH PATENTS FROM THE 21ST OF JULY TO THE 22ND OF AUGUST, 1849.

James White, of Lambeth, Surrey, civil engineer, for improvements in machinery or apparatus for sowing seed. Sealed, July 25; six months.

James Green Gibson, of Ardwick, near Manchester, Lancaster, machinist, for certain improvements in machines used for preparing to be spun or spinning cotton and other fibrous substances, and for preparing to be woven and weaving such substances when spun. July 30; four months.

Andrew Peddie How, of the United States, but now residing at Basinghall-street, London, engineer in the United States Navy, for an instrument or instruments for ascertaining the saltness of water in boilers. (Communication.) August 1; six months.

Hugh Lee Pattinson, of Washington-house, Gateshead, Durham, chemical manufacturer, for improvements in manufacturing a certain compound or certain compounds of lead, and the application of a certain compound or certain compounds of lead to various useful purposes. August 6; six months.

Amedée François Remond, of Birmingham, for improvements in machinery for folding envelopes, and in the manufacture of envelopes. August 6; six months.

Richard Keinsley Day, of Stratford, Essex, hydrofuse manufacturer, for improvements in the manufacture of emery paper, emery cloth, and other scouring fabrics. August 7; six months.

John Thom, of Ardwick, near Manchester, calico printer, for improvements in cleansing, scouring, or bleaching silk, woollen, cotton, and other woven fabrics and yarns, and in aging fabrics and yarns when printed. August 7; four months.

Joseph Findlay, of New Sneddon-street, Paisley, Renfrew, manufacturer, and Andrew Wilkie, of the same place, turner, for an improvement or improvements in machinery or apparatus for turning, cutting, shaping, or reducing wood or other substances. August 10; six months.

James Thomson Wilson, of Middlesex, chemist, for improvements in the manufacture of sulphuric acid and alum. August 15; six months.

Edward Lord, of Todmorden, Lancaster, machinist, for certain improvements in machinery or apparatus applicable to the preparation of cotton and other fibrous substances. August 15; four months.

Pierre Armand le Comte de Fontainemoreau, of No. 4, South-street, Finsbury, for certain improvements in weaving. (Communication.) August 22; four months.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Symes Prideaux, of Southampton, gentleman, for improvements in puddling and other furnaces, and in steam boilers. August 30; six months.

James Robinson, of Huddersfield, York, orchil and cudbear manufacturer, for improvements in preparing or manufacturing orchil and cudbear. August 30; six months.

Charles Morey, of Manchester, gentleman, for certain improvements in machinery or apparatus for sewing, embroidering, and uniting or ornamenting by stitches various descriptions of textile fabrics. August 30; six months.

A grant of an extension for the term of five years of a patent to George Baxter, of Northampton-square, Clerkenwell, Middlesex, engraver and printer, for his invention of improvements in producing coloured steel-plate, copper-plate, and other impressions. August 30.

Isidore Bertrand, of France, engineer, for an improvement in protecting persons and property from accident in carriages. August 30; six months.

Onesiphore Pecqueur, of Paris, civil engineer, for certain improvements in the manufacture of fishing and other nets. August 30; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Aug. 23	2009	T. W. Ingram	Bradford-street, Birmingham, button manufacturer	Self-calculating steelyard.
24	2010	Thomas Melling	Rainhill Iron-works	Improved double-sash window.
,,	2011	William Crane Wilkins	24, Long Acre	Improved spring weighing-machine.
27	2012	Rigby and Duckrell	1, Vauxhall-walk	Monastic escritoire slot, slide wax vesta, and chemical light-box.
28	2013	George Aldred	Primrose-street	Spindle and spring for a looking glass.
29	2014	Stock and Son	Birmingham	Gas burner.
,,	2015	Sutherland and Murdoch	Dundee	Valve-cock or trap.
"	2016	Thomas Banbury Randle Ball	Hill-street, Coventry, watch manufacturer	Improved watch.
,,	2017	Alexander Symons and Alexis Soyer	5, Charing-cross	Soyer's modern housewife's kitchen apparatus.
,,	2018	Alexander Symons and Alexis Soyer	5, Charing-cross	Soyer's magic stove.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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No. 1361.] SATURDAY, SEPTEMBER 8, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

BIRAM'S PATENT MINERS' LAMP.

Fig. 1.

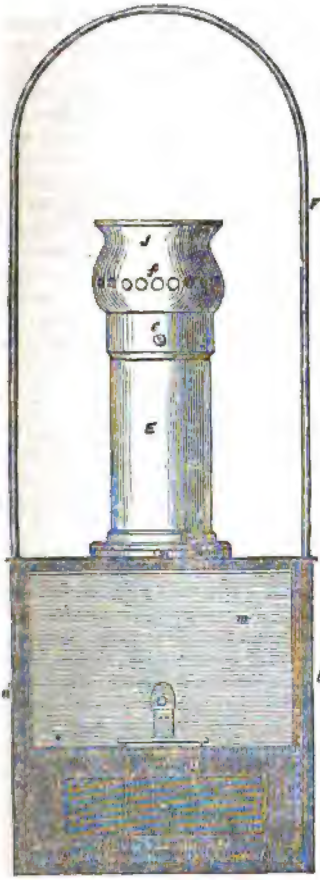


Fig. 2.

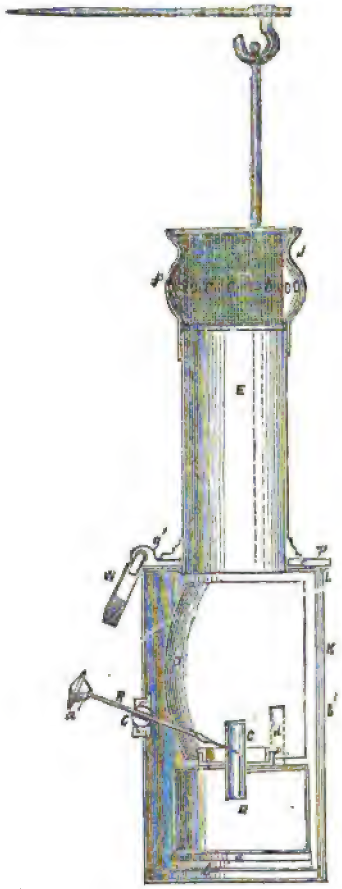


Fig. 3.

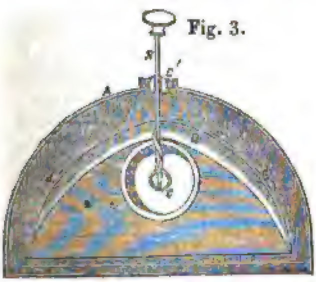
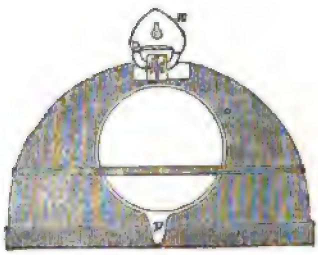


Fig. 3*a*.



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BIRAM'S PATENT MINERS' LAMP.

Fig. 1.

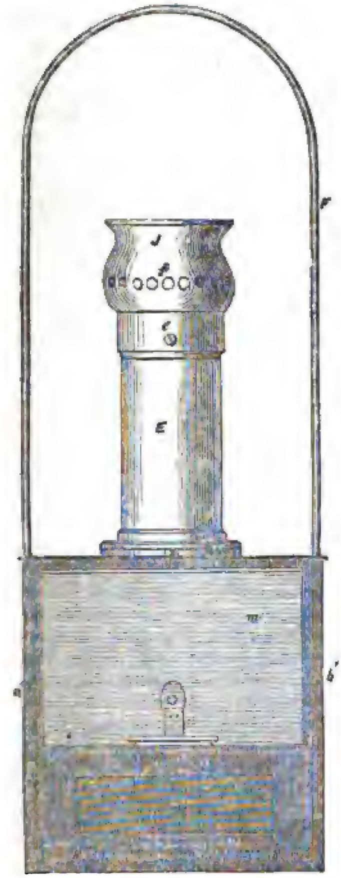


Fig. 2.

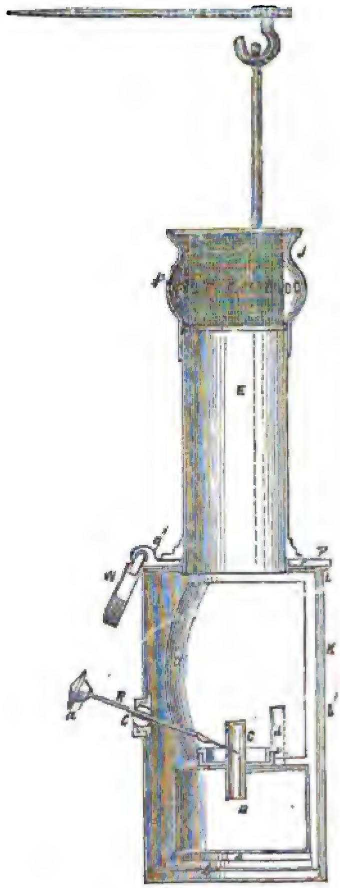


Fig. 3.

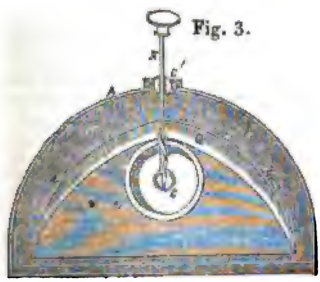
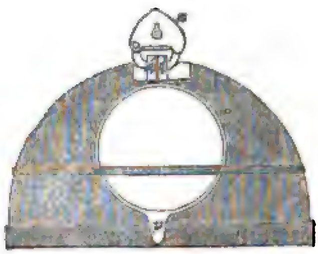


Fig. 3ª.



BIRAM'S PATENT MINERS' LAMP.

[Patent dated February 28, 1849. Patentee, Mr. Benjamin Biram, of Wentworth, in the County of York.]

Mr. Biram's invention has for its object to increase the light obtainable from those miners' lamps which are constructed on the principle of what is called "the Davy Lamp," and to afford better protection to the flame from currents of air. These several improvements are accomplished by constructing such lamps in the manner of the one represented in the annexed engravings. Fig. 1, is an external elevation of this lamp in its complete state; fig. 2, a side elevation of it partly in section; fig. 3, a plan on the line a^1 b^1; and fig. 3^a, a top plan. A is the external case, which is of the ordinary semicircular form, and suspended by a curved handle, F; B is the oil reservoir and wick-holder: this reservoir is slid in the casing, on grooved or mutually overlapping pieces, *a b*, one of which is affixed to the bottom of the case, and the other to the bottom of the reservoir: and *c* is a ring, by which the reservoir, B, is pushed into its place or drawn out when required to be replenished. C is the burner, with circular tube and wick, as usual; D is a metallic reflector of a parabolic or other suitable curvature, which is mounted behind the burner on two pins, *d d*, which rise from the top of the reservoir, B, and take into two short tubes soldered to the back of the reflector. E is a chimney, which rises from the top of the case (A), and may be made either wholly of metal or principally of wire gauze (like the common Davy lamp.) If made of metal, it is surmounted by a cap, J, which is closed at top, but perforated in the sides by a circle of holes or slits, *f f*, which are protected within by a screen of wire gauze, *g* (see fig. 2); *e* is a screw, by which the cap, J, is made fast to the chimney, but which can be undone in order to allow the cap to be removed when it is necessary to examine, clean, or renew the wire gauze; K is the door, which drops into grooves made for it in the front edges of the case, and consists of a metal frame divided into two compartments; the upper and larger of which, *m*, being that in front of the light, is filled with talc, and the lower and smaller, *n*, is fitted with a portion of wire gauze, through which (alone) the air necessary to support the flame is supplied. The frame may be made a little narrower towards the bottom than at top, in order that it may the more easily be dropped into or raised out of its place; but when it has been once fixed in its place, care should be taken that it fits accurately throughout, and especially that the top flange, *l*, is brought close down over the grooves in which the door slides. P is a ring, which turns in a seat made for it on the outside of and close to the bottom of the chimney, E; *p*, a pin which projects from the ring, P, and passing over the top of the door, K, secures it in its place; q^1 is an eye-piece, which is attached to the back of the ring, P, and is in the same diametrical line with the pin, *p*; and q^2 a companion eye-piece, which is affixed to the top of the case, A, and against which the other eye-piece abuts, when the pin, *p*, is moved round into a central position over the door, K.

When the two eye-pieces are brought side by side, the hasp of a small padlock, W, is passed through them, and the interior of the lamp thus perfectly secured against all meddling or intrusion; C, (fig. 2,) is a ball and socket or universal joint fixed in the back of the case, A; and R a pricker for raising, depressing, or trimming the wick, which is passed through the ball and through a corresponding opening in the focus of the reflector, D. The pricker is free to move to and fro through the ball, but within certain limits determined by a twist, which is given to it at the inner end, to prevent its being entirely drawn out; and it has thus the power of universal movement, not in one plane only, but in as many different planes as come within the range of its to-and-fro movement through the ball. The lamp when in use may be suspended from a steel spike driven into the coal or into a wooden prop, and this spike may have a swivel hook at top, by which it may not only be attached for convenience of carriage to the handle, F, of the lamp, but be readily turned round from one position into another.

When this lamp is taken into an inflammable atmosphere, the noxious gas which passes through the under or gauze

compartment of the door ignites and burns within, with a slight blue flame, and very soon absorbs the supply of oxygen to the lamp and extinguishes the flame (unless the lamp is removed into fresh air), but with no other inconvenience to the bearer than the loss of his light.

To enable a person to work in a part of a mine charged with carburetted hydrogen (which may sometimes be necessary for a short time), a circular opening, protected by wire gauze, may be substituted for the under compartment, *n*, as indicated by the dotted lines, *t t* (fig. 1), and a tube of vulcanized India-rubber or other flexible material fitted to this circular opening; which tube may be of any length required to reach into the pure air. The lamp would then burn freely and securely for any length of time, being supported with pure air; although the workman himself might, it is true, be exposed to danger from breathing air deleterious to health, or even destructive of life.

Instead of the door being made in two compartments, one filled with talc and the other with wire gauze, it may be made with a single opening by substituting wire gauze for the talc. Probably for viewers or overmen the talc may be preferred, and for working miners the wire gauze. The patentee has ascertained by numerous experiments that the light emitted through clear talc is rather more than that of four candles, and the light emitted through the wire gauze (in a lamp of this improved description) is about equal to that of an ordinary pit candle.

For Claims, see *ante* p. 209.

CLUB-HOUSES FOR THE WORKING CLASSES.

Masters and men engaged in mechanical pursuits have even a greater interest than the general philanthropist in all that contributes to the well-being of the operatives, therefore the lodging of this class of persons seems suitable matter of consideration by the readers of the *Mechanics' Magazine*. Sir Samuel Bentham, "considering how closely those who have speculated on the providing habitations for workmen and others belonging to or dependent on naval arsenals, have crowded them together, regardless of the discomfort of the inhabitants, and of the injurious effect on health of the want of cleanliness and air, whereby fevers and other contagious disorders are as frequent and fatal in the neighbourhood of naval arsenals as in the most crowded and unhealthy parts of the metropolis,"* recommended that at Sheerness, when the Dock Arsenal should be renovated, a new town should also be built "according to a general design, in the formation of which the construction of the houses should be such as should be the least liable to accidents from fire, and in which the several fundamental considerations and arrangements for cleanliness should be considered and provided for." But his plan for the arsenal itself not having been honoured with consideration, details of his design for a new town were never completed; as, however, he had bestowed much thought upon the subject, some of his ideas were, early in 1846, thought applicable to dwellings for the industrious classes in large towns—then a subject beginning to become of public interest; and as no plan for any such establishment had that time been elicited, a scheme for a suitable building, grounded on his ideas, was sent to the *Builder*, and was inserted in that periodical April 18, 1846. About the same time a similar proposal was submitted to the Association for bettering the condition of the working classes. This proposal was entitled, "Club Dwellings for the Working Classes."

That project was based on the mischiefs and misery consequent on the too early marriage of that description of persons, before they have had time to lay up some little reserve of money in case of illness or a growing family, and from a conviction that these improvident unions are too frequently entered into, solely because the man has no place to go to but the public-house for warmth and rest when the day's work is done; the main object of the proposal, therefore, was not only to provide a sleeping-place for single men, but also wholesome food, a comfortable place of rest and an inducement, as well as means of substituting for the immoral pleasures of the tap-room the more salubrious and elevating recreation of reading, all of these advantages being to be

* Letter to the Navy Board, February, 1812, Desiderata, article 28.

provided at a less expense than the ordinary expenditure of such persons for board and lodging.

It was said, in the *Builder*, that "Buildings on a large scale can, as is well known, be constructed at a less cost per cube foot of interior space than small ones; and can also be warmed, ventilated, and lighted at a less comparative expense. So provisions can be purchased, cooked, and served, at a lower rate in large than in small quantities. These considerations have given confidence as to the economy of the plan proposed."

The article then specifies a general arrangement for such a building: the basement was to consist of a suitable kitchen and butlery, with appropriate coal and other cellars, the apparatus for heating and lighting the whole building, for the supply of water, baths, and drying room for wet apparel, &c.; next above a dining and coffee-room, a library and reading-room, a dispensary, and apartments for the general manager and porter. The several stories of the upper part were appropriated as sleeping rooms, a separate one for each individual: but the arrangement in this respect differed from what was in contemplation for Sheerness, and this at the recommendation of a friend as more consonant to received ideas; so that, in the *Builder*, it was proposed that these separate chambers should open to an internal corridor, like the best cabins in Greenwich Hospital; but it had been projected for Sheerness to take example from many old inns, and have the sleeping chambers to open from an external gallery. It can hardly be hoped in numerous assemblages of the working classes, that all should abstain from inebriating liquors, and a single intoxicated man would be sufficient to disturb all those in the whole range of chambers of the same corridor; but the great advantage of the exterior gallery is the sanitory superiority it possesses. A single individual labouring under contagious disorder—typhus fever say—would probably communicate his malady to many of those exposed to it by the general internal corridor; but sleeping rooms opening each to an external gallery, would afford to their inmates all the security that is so well known to result from a dilution of the contagious principle with atmospheric open air. These chambers might be of sufficient size, if about six feet six in width by ten feet long; there would be the coffee and dining-room for rest and social chat, the reading-room for more silent recreation,—so that the separate chamber need only to afford space for a bed along the inner end, a door and window in front, a press for clothes, the washing apparatus under the window, with clean water tap, and provision for running off soiled water, the whole covered by a flap table.

The general management proposed for these club dwellings was borrowed from that which has been so successful in the great London clubs, that is by a committee chosen by the general mass of residents from amongst their number. The chief business of this committee would be to see to the good quality and fairness of price of provisions furnished from the kitchen and butlery; the cleanliness of apartments, to be kept in order by a female resident—a porter's wife, no doubt; the orderly conduct of the inmates, according to general rules. In no way is superior food obtained in London so excellent in quality, and at so low price, as in the great club-houses. So the kitchen of these club dwellings might be expected to "supply better diet than is habitually obtained by the single workman, and at a lower price."

Success in such establishments would materially depend on *ready-money* payments. Rents of lodgings for the working classes are greatly enhanced to the punctual, by the defalcations of others less exact; landlords count upon an average loss of rent, so that the charges are on the average of those who pay, and of those who are defaulters, whereby the honest man pays often double the rent that would be remunerative were the landlord not subjected to such losses. It was therefore proposed, for "his security, and consequently the low rent at which lodgings could be afforded," "that it should be paid in advance; and that from the first it should be stipulated that no credit would be allowed. In foreign countries where rents, from the highest to the lowest, are habitually paid in advance, many are the advantages found to result from this practice." "To the tenant, if honestly paying his rent as it becomes due, it can make little difference whether it be at the beginning or the end of the week; whilst to the thoughtless it ope-

rates as a check to useless, or extravagant expenditure; to the intentionally dishonest, this establishment is not intended as an asylum."

This mode of pre-payment has been adopted by the "Metropolitan Association for Improving the Dwellings of the Industrious Classes" with marked success, where lodging for a single night is afforded; but it is said that in the model lodging-house for families, already there has been twice occasion to distrain for rent—painful and costly expedient for the landlord, often a ruinous one to the tenant, his furniture selling always for less, much less, than its real value, independently of the consequent suffering from loss of articles he perhaps never may be able to replace; surely it must be more moral and humane to prevent ruinous want of foresight in the working man, than to encourage his indulgence for a time in expenses beyond his means.

It may be objected to these club habitations that workmen, as carpenters and bricklayers, cannot be sure of employment in the same neighbourhood; but in very many businesses, operatives to the amount of many thousands are constantly employed the year round on the same spot; for example, those in the printing, bookbinding, and publishing trade, and those in the employ of manufacturing engineers. Indeed, however distant the work, men are in the habit of going to the same place to sleep; and for meals, were such club-houses established in different parts of the town, it would not be difficult to devise some kind of certificate from the house of general residence, so that the bearer of such a document might be admitted in similar establishments for meals, at least on the same terms as the regular inmates.

Hitherto model lodging-houses have unfortunately been regarded as a sort of charitable institutions, so as to have deterred many men of honest and independent feelings from having recourse to such buildings; but as the association have already done the immense service of ascertaining that improved lodgings let at low rents may be made remunerative, it now mainly rests with the operatives themselves to obtain superior habitations by encouraging capitalists to build them.

Much as such club dwellings are desirable for men, they are still more needed for women; this too regards, then, operative mechanics, for very many of them have to lament the want of appropriate habitations for unprotected sisters: "Buildings on the same general plan," says the *Builder*, "might be constructed for single women; although as their earnings are comparatively very small, the accommodation to be provided would necessarily be on a smaller scale. In this case the reading-room would become a work-room for such of the inmates as might be sempstresses." "In truth, to persons conversant with the hardships females of this class endure, and the temptations to which they are subjected, it may seem that cheap respectable lodgings for women and girls are even more required than for men."

The insalubrity of narrow streets, courts, and alleys, led Sir Samuel to consider whether some rule might not be made general by which due ventilation might be secured in every part of a town; he conceived that in no case the interval between opposite rows of houses should be less than twice the height of the buildings. Acts of Parliament are apt to impose unnecessary restrictions on builders, but perhaps some such enactment as to the width of streets might materially contribute to general health.

It is said of the model lodging-houses for families, that much inconvenience in them is experienced from the general staircase. This would be in a great measure obviated by making the entrance to the houses from an external gallery connected with an external stair, as is customary in many foreign countries. The stair would, it is true, be liable to wet as well as mud, but it would be more easily cleaned than an internal one, and would be far less liable to the abominations frequent in all countries where a general staircase affords shelter to the houseless.

In the plan for a new town at Sheerness, surrounded as it is with marshes, he thought it essential that all dwelling houses should be as high as was consistent with economy and general convenience, since it had been found in marshy districts — the Maremma of Italy, for example — that the higher bed rooms were elevated above the ground, the less their inhabitants suffer from *malaria*. He therefore proposed that houses consisting even of so few as four rooms,

should have them one above the other. Such houses when not in streets, to be built in groups of four for cheapness, the houses so oriented as that the sun should shine on all of them some part of every day; and each habitation to have its fore-court and side-garden. Of course, the entrance to these groups would be from different streets.

That private houses, as well as public buildings, should be fire-proof, duly drained, plentifully supplied with water, and well ventilated, entered generally into all Sir Samuel's projects, has been seen in the *Mechanics' Magazine;* but the obtainment of these improvements depends more on mechanical means and engineering skill than on general architectural knowledge; it is therefore to be hoped that mechanists and civil engineers will turn their attention more than has hitherto been done to plans for houses and towns, and that the *Mechanics' Magazine* will lend its aid by exhibiting from time to time the progress that may be made in such improvements, and the means by which they may be effected.

M. S. B.

ON CONGENERIC SURD EQUATIONS.

Sir,—Will you allow me to occupy a small portion of your valuable columns with a few remarks suggested by the perusal of a paper by Professor Young, printed at page 463 of your 49th volume?

The part of that paper to which I would draw attention is that which relates to the inadmissibility of the equation $-0=+0$. The argument used is thrown into the following form, the steps of which I have taken the liberty of lettering;

(A) $-0=+0$

(B) $-\infty=+\infty$ (misprinted $-\infty=+0$)

(C) $0=2\infty$.

Now, when we reach a contradictory result like this, it is certain that it must arise from one of two causes—either the premises involve a contradiction, or the chain of reasoning is defective. Professor Young appears to hold (though not without some misgivings) that the first-named of these two causes is the one acting here, while to my mind it seems clear that it is the second; and it is in support of this opinion that I now proceed, with your permission, to make a few remarks.

With all the respect for Professor Young which his high standing as a mathematician demands, I may state that in my opinion there is involved a *petitio principii* in the step from (A) to (B), and that this *petitio principii* arises from a confusion of two distinct meanings, which are attached in most works on algebra to the symbol 0. These meanings are the following:—If, in the identity

$$n=n,$$

we transpose either of the equal quantities, we have

$$n-n=0;$$

here 0 expresses the absence of all magnitude, or that which remains when the whole of a thing is taken away. Again; if we consider a series of terms such as

$$\tfrac{1}{2}, \tfrac{1}{4}, \tfrac{1}{8}, \tfrac{1}{16}, \text{\&c.},$$

we see that no term of it ever becomes $=0$ (in the sense in which it is used above), but that by going on far enough with the series, we can approach as near to 0 as we please; hence 0 is the *limit* to which we approximate more and more as we go on. It is the custom, however, though a bad one, as I think, to say that if we continue the series to infinity, we at last *do* obtain 0. For my own part, I prefer the language of limits, and such a form of expression as, "by continuing the series, we can approach 0 as closely as we like." But throwing aside the question as to which is the better form of stating the property of the series, it is evident that the symbol 0 is used in a very different sense in this instance, to that in which it was employed in the former; and it appears to me that much of the confusion and difficulty which attend the use of the symbol 0, has arisen from a want of clear definition in each particular instance as to what kind of zero was meant.

If we for a moment distinguish these two symbols as the *absolute* and *relative zeros*, we shall be better able to point out the differences between them.

1st. *Of the absolute zero, or what remains on taking a quantity from its equal.*

All absolute zeros are equal; for, from the identity,

$$a+b=a+b,$$

we have, of necessity,

$$a-a=b-b.$$

It follows that, whatever results we may obtain from the consideration of the particular case $1-1$, will apply generally to all absolute zeros. No person, I should think, would be so bold as to assert that in any expression consisting of term connected by + or −, the value of the expression is altered by changing the order of the terms; consequently,

$$1-1=-1+1,$$

but

$$-1+1=(1-1)\times-1;$$

therefore,

$$1-1=(1-1)\times-1,$$

or

$$+0=+0\times-1=-0.$$

Again; the reciprocal of $1-1$ or 0, will be found by dividing unity by that quantity. If we actually perform the division, we shall obtain as quotient

$$1+1+1+\ldots\ldots \text{\&c., } \textit{ad infinitum},$$

or

$$\frac{1}{+0}=\frac{1}{1-1}=+\infty;$$

where by ∞, I mean an infinite quantity, absolutely and strictly according to the meaning of the word infinite—that is, a quantity *without end*. If now we take the other form of the absolute zero, obtained by changing the order of the terms, namely

$$-1+1,$$

and divide unity by it, we shall obtain

$$-1-1-1-1, \text{\&c.},$$

or

$$\frac{1}{+0}=\frac{1}{-1+1}=-\infty,$$

or the absolute zero has TWO RECIPROCALS, *which are positive and negative infinity;* that is,

$$\frac{1}{+0}=\frac{1}{-0}=\mp\infty.$$

It is evident that there is a *false* step in the reasoning quoted at the commencement of this letter in passing from (A) to (B): from the equation

$$+0=-0,$$

it does not follow that

$$+\infty=-\infty.$$

It would be just as logical to argue thus,

$$(+a)^2=(-a)^2,$$

therefore

$$+a=-a;$$

the fact is, that in both cases there is the tacit assumption that the same sign is to be used on both sides of the equation. From

$$+0=-0,$$

all that we can derive is

$$+\infty=+\infty, \text{ or } -\infty=-\infty,$$

which leads to no result.

2nd. *Of the relative zero, or* 0, *used as a contraction of the language of limits.*

As 0 used in this sense always expresses a quantity which does not change sign, in consequence of never really vanishing, it is plain that its reciprocal never changes sign either, but that we have

$$\frac{1}{+0}=+\infty \text{ and } \frac{1}{-0}=-\infty;$$

(∞ being used in a relative sense also); nor are all relative zeros equal; indeed, the whole doctrine of the differential calculus depends on the fact of their not being all equal.

I have not seen the equation to which the above-quoted argument was applied by Professor Young; but I suppose it to be an ordinary algebraic one;—in which case, any zero considered could be only what I have called above an absolute zero, and therefore the error of the result is, in my opinion, due to an error of reasoning. If, however, it be a relative zero, it is plain that the error pre-exists in equation (A); as for relative zeros, it is false that

$$+0=-0.$$

I am, Sir, yours, &c.,

N. Y. R.

Trinidad, June 5, 1849.

DESCRIPTION OF A PNEUMATIC LIFT IN USE AT CORBYN'S HALL NEW FURNACES, NEAR DUDLEY. BY BENJAMIN GIBBONS, OF SHUT-END HOUSE, ESQ.

[Being the substance of a Paper read before the Institution of Mechanical Engineers, Birmingham, July 25, 1849.]

In some districts the levels of the ground admit of the furnaces being charged by wheeling the materials on a level platform from higher ground to the top of the furnaces, but in general these have to be raised by machinery to the level of the top of the furnaces, the height raised being about 40 to 50 feet. The usual plan of raising the materials is by an inclined plane, which rises from the ground to the top of the furnaces at an angle of about 30°; there are two lines of railway upon it, and a travelling

platform on each line, drawn up by a steam engine by means of a chain passing over a pulley at the top of the inclined plane. The two platforms balance one another, one of them descending while the other ascends, and the top of each platform is made horizontal and works level with the ground at the bottom and with the stage at the top of the furnaces, so that the barrows of materials are readily wheeled on and off the platforms; several barrows are carried by each platform. A rack is fixed on the inclined plane along the centre of each line of railway, and a catch is fixed on the moving platform which falls into the teeth of the rack in ascending, for the purpose of stopping the platform and preventing an accident in the case of the chain breaking; but the use of this catch is found to be inconvenient in practice, and is generally omitted. There is a difficulty in stopping the platform at the required level, and the inclined plane is objectionable from the space which it occupies and the expense of its construction.

Where the inclined plane cannot be employed, the power of the steam engine is not employed directly to draw up the materials vertically by a chain, because of the difficulty in working it conveniently and safely, to stop the platform at the correct level for wheeling the barrows on and off, and prevent the risk of serious accident by the chain breaking, particularly in the night work. At some iron-works an endless chain is used for this purpose with a series of buckets fixed upon it, which are filled with the materials at the bottom and empty themselves into the furnace by turning over at the top. This lift is not suitable for supplying more than one furnace; and when there are more than one furnace it is most advantageous to employ a lift that will take up the materials in the barrows, ready for wheeling at the top to the different furnaces.

Another plan for lifting vertically is by means of a water balance; the platform on which the barrows of materials are raised is suspended by a chain passing over a pulley at the top, and a bucket is attached to the other end of the chain; the platform in descending draws up the empty bucket, and when the platform is loaded the bucket is filled with water until it overbalances the loaded platform and draws it up. There is an important objection to this plan, that the bucket descends with an accelerated velocity, and a friction break has to be used to check the velocity to prevent a violent concussion on stopping its momentum at the end of the descent; this causes a risk of accident from breakage of the chains, and the friction break is also liable to derangement and expensive repairs.

At the Level Iron-works, near Dudley, an instance occurred where a vertical lift had to be introduced in consequence of the furnaces being raised 16 feet in height; there were two furnaces, originally 34 feet high, and raised to 50 feet high, and at the original height the materials were wheeled on the level to the top of the furnaces. When the height of the furnaces was increased the materials were required to be raised 16 feet, and a vertical lift was necessary in consequence of the situation being so much confined by a canal as to prevent the adoption of an inclined plane. For this purpose the author of the present paper constructed a pneumatic lift, worked by the pressure of the air from the blowing engine that supplied the blast for the furnaces. This lift was designed with the object of avoiding the objections to the plans of vertical lifting previously in use, and obtaining a safer and more economical application of power.

This pneumatic lift consisted of a heavy cast-iron cylinder, 4 feet 4 inches diameter inside, closed at the top, and inverted in a well filled with water, in which it was free to slide up and down like a gasometer; this cylinder was suspended from the top by a chain fastened to the circumference of a pulley which was fixed on a horizontal shaft above the level of the top of the furnaces. A pipe from the air-main was carried down the well and turned up inside the cylinder, rising above the surface of the water, and when the blast was let into the cylinder through this pipe, the cylinder was raised in the water by the pressure of the compressed air against the top; this pressure was about 2 lbs. per square inch. A platform for raising the barrows of materials was suspended by a chain from another pulley on the same shaft as the former pulley, and the platform was guided in its ascent by vertical framing. The cylinder was heavy enough to draw up the platform with the load upon it by descending into the water when the blast was withdrawn; and the empty platform was lowered by admitting the blast into the cylinder and thus raising it. The cylinder was lowered again by opening a valve which let out the compressed air, and its velocity of descent was regulated by opening this valve more or less. The velocity of the platform both in rising and falling was completely under command, by regulating the opening of the valves for admitting or letting out the compressed air, and the velocity was gradually checked towards the end of each stroke with certainty and ease, so as always to stop the

platform without concussion. The height to which the cylinder was raised was only 5 feet, and the two pulleys were made of different diameters so as to raise the platform 16 feet; the load raised upon the platform was about half a ton. This pneumatic lift has now been in constant work for 39 years, and has worked quite satisfactorily during the whole time: it has not required any repairs except renewal of the chains and repairs of the rubbing parts. An accident happened once by the chain breaking whilst lifting, and the platform fell about 5 feet, causing a shock to the man going up with it, but no injury was done to the machinery.

An improvement on this pneumatic lift was was made by the author of the present paper, in constructing a lift on a considerably larger scale at the Corbyn's Hall new furnaces. The height to which the materials have to be raised is 44 feet 6 inches, and the present plan was designed to prevent the risk of an accident occurring through the breaking of a chain. There are four furnaces supplied by this lift, which is fixed between two of them, and the four furnaces are connected on the same lever by the staging at the top, on which the barrows of materials are wheeled from the platform of the lift.

In this lift the platform for raising the barrows of materials is fixed on the top of the air cylinder, and it is raised by the pressure of the blast, the action being the reverse of the former plan.

[A detailed description here follows of the engine, illustrated by drawings.]

. . . . .

The total pressure of the compressed air against the top of the air cylinder is 3¼ tons; and deducting the unbalanced weight of the cylinder and platform ¼ ton, this gives an available lifting power of 3 tons. The load of materials raised varies according to the working of the furnaces, and the average load of materials raised each time is 1½ tons, exclusive of the barrows and men, or about 2 tons gross weight. The lift is raised 16 times per hour during 20 hours in each day of 24 hours, or once in 3¾ minutes; and the total weight of materials raised each day is about 500 tons. The time of raising the platform from opening the inlet valve to reaching the top is from 50 to 70 seconds, according to the load in regular work; and the time of lowering the platform is from 30 to 50 seconds, according to the degree of opening of the escape valve on the top of the air cylinder; the empty platform can be raised in 45 seconds, and lowered in 25 seconds, with the present size of apertures.

In raising the platform, the inlet valve is kept fully open until the platform arrives at 14 inches distance from the top, when it catches a lever, which gradually draws up the plug of the inlet valve, so far as nearly to close the pipe leading to the air cylinder; this checks the moving power, and causes the velocity of the platform to be so much retarded by the time it arrives at the top, that the platform stops dead against the wood blocks without any concussion being felt. The platform is held firmly up to these stops by the pressure of the air as long as may be required, without any recoil, and without requiring any catches to hold the platform, as it cannot descend in the least unless the air is allowed to escape from the cylinder; and the supply from the air pipe keeps it full, in the case of any leakage taking place. When the platform is raised empty, a wood block turning on a pivot is slipped by the foot under the lever that closes the inlet valve, so as to begin closing the valve sooner; this is adjusted according to the velocity of the ascent of the platform, and regulates the lifting power so as to prevent any concussion on stopping at the top of the ascent.

When the platform arrives at the top, the men who go up with the barrows, wheel them off to discharge the materials into the several furnaces; and as soon as the empty barrows are brought back, the platform is lowered by drawing up the plug of the inlet valve to the top, which shuts off entirely the supply of compressed air, and opens the exit below the plug for the air in the cylinder to escape. This is done by the men on the platform at the top, by means of a rod from the valve carried up the framing; and the escape valve on the top of the cylinder is then opened and kept open till the platform is near the bottom, when it is closed, and the velocity of the platform is so much checked before stopping, that scarcely any concussion is felt at stopping; it can easily be stopped without any concussion.

The velocity of the platform is also gradually checked in descending by the gradual immersion of the cylinder in the water, which reduces the unbalanced weight of the cylinder. The total loss of weight of the cylinder, when at its greatest immersion in the water, is ¼ ton, which reduces the effective unbalanced weight of the cylinder and platform from ¼ ton to nothing; but the weight of the four chains amounting to ⅛ ton, is added to the balance weights at the beginning of the descent, and is transferred to the platform at the end of the descent, and the result is, that the moving power causing the descent of the platform is reduced ¼ ton during the descent, being about ⅜ ton at starting, and ⅛ ton at stopping;

this moving power can be altered as required by altering the balance weights.

This lift was originally constructed to work only two furnaces, and the air pipe was only 5 inches inside diameter, and the time of raising the platform was usually 140 seconds; when the other two furnaces were added, it became necessary to add a second air pipe of the same size, for the purpose of working the lift twice as fast. When the lift was constructed it was found that the well could not be made sufficiently water-tight, on account of a slight disturbance in the strata from the getting of the neighbouring mine, and an outer cylinder of similar construction to the air cylinder was consequently sunk into the well; this outer cylinder has a close bottom, and holds the water in which the air cylinder works, like the tank of a gasometer.

The quantity of air blown into the cylinder each time of raising it is 1128 cubic feet, and the total quantity per day of 24 hours, is 360,960 cubic feet, or about 12 tons weight of air; the total quantity of air blown by the blast engines is 16,185 cubic feet per minute, and 23,306,400 cubic feet, or about 780 tons weight of air per day of 24 hours. The proportion of the total blast that is used by the lift is therefore as 12 tons to 780 tons, or $\frac{1}{65}$ of the whole, and consequently $\frac{1}{65}$ part of the total power of the blowing engines is employed in working the lift; there are two blowing engines employed. The pressure of the blast is $2\frac{1}{4}$ lbs. per square inch, and the total engine power is consequently 165 horse-power; and the air consumed by the lift being $\frac{1}{65}$ of the total blast, it follows that $\frac{1}{65}$ of 165, or $2\frac{1}{2}$ horse-power, is the power that is actually employed in working the lift; this power being a constant power, acting during the whole day, instead of acting merely at the times when the lift is rising. The actual power required to elevate the lift, with the average gross load of 2 tons on the platform, or $2\frac{1}{4}$ tons total weight, including the average unbalanced weight of the cylinder and platform, raised 44 feet 6 inches in 70 seconds, is 6 horse-power; the greatest power employed being $3\frac{1}{2}$ tons raised that height in 70 seconds, which amounts to 9 horse-power, and the least is $\frac{1}{2}$ ton raised in 45 seconds amounting to 1 horse power. Thus it appears that the work of 6 horse-power, occurring at intervals, is performed by a power of $2\frac{1}{2}$ horse-power constantly acting.

The total consumption of coal-slack by the blowing engines is about 13 tons per day of 24 hours, consequently the expense of working the lift is $\frac{1}{65}$ part of this, or 4 cwt. of coal slack per day, costing about 5*d*. per day; and as this lift raises 500 tons of materials per day, it follows that 100 tons are raised 44 feet 6 inches high for 1*d*., or 4,450 tons raised 1 foot high for 1*d*. The quantity of air required to fill the cylinder of the lift is 1,128 cubic feet, and the total contents of the blowing cylinders for one double stroke is 1,056 cubic feet; consequently an increase in the rate of the engines of one stroke per minute is sufficient to raise the lift in 70 seconds, without diminishing the supply of air for the blast of the furnaces.

These two circumstances cause an important economy in working this pneumatic lift: a small power constantly acting is sufficient to do the work, and the sudden application of this power concentrated into a short time causes but a small increase in the rate of the engine. The total cost of this lift was about 500*l*.; and the cost of an inclined plane lift, including the engine for working it, would be about double that amount.

This pneumatic lift has been in constant work for the last nine years, and no accident or stoppage has occurred with it, except that the chain of one of the balance weights broke once; the platform stopped with a very trifling fall, and was held in its position by the pressure of the air; no damage was caused, and the lift was got to work again within an hour's time. The only repairs that have been required since it commenced working, are the renewal of the chains of the balance weights and repair of the pulley bearings; the set of chains can be taken off and replaced whilst the lift is standing during the dinner-hour, without causing any delay to the work. This is an important advantage, as it is essential to ensure a continued supply of materials to the furnaces, and to avoid any risk of stoppage for repair of the lifting machinery.

The platform in this pneumatic lift cannot fall quicker than the time in which the whole body of air can escape, amounting to 1,128 cubic feet; and the greatest leakage that can arise from an injury of the cylinder cannot let it down so rapidly as to cause any damage. The load is supported by an air cushion during the whole time of its ascent, instead of depending on chains or racks, which prevents any risk of its falling. The complete control over the motion of the platform that is given by the air valve which regulates the entrance and exit of the air, gives the means of checking, stopping, or reversing the motion at any part of the stroke; and it prevents any concussion at the ends of the stroke, although the lift has a quick action, and is stopped dead at each end of the stroke at the exact level required. The friction of the lift is very small, as the

cylinder works through a water joint; and in consequence of the low pressure at which it is worked the loss at any leak is very small, and the strain upon the joints is much diminished.

The pneumatic lift is of course applied most economically and conveniently in the case of blast furnaces, where the compressed air can be obtained very economically and without additional machinery; but it is probable that its application may be extended advantageously to several other cases, such as raising railway waggons, or even railway trains, discharging vessels at quays, and various other purposes, and it possesses several advantages which make it deserving of consideration. The low pressure at which it is worked causes great simplicity and economy in the construction and working, the loss at leaks being reduced, and the joints easier kept in order; and the friction is very small, as the cylinder works through a water joint. Where the lift is not required to be always working, but only to be worked at intervals, a further economy could probably be effected by employing a reservoir for the compressed air, to accumulate power during the time that the lift is not required to work, and thus reduce the size of engine requisite for the work; a large capacity of reservoir could be constructed at a moderate expense, on account of the low pressure upon it. It may be mentioned that at the Corbyn's Hall New Furnaces the reservoir of compressed air contains 5000 cubic feet at the pressure of the blast, 2½ lbs. per square inch, and consists of four wrought-iron cylinders from 6 to 8 feet diameter, constructed of riveted plates from one-eighth to three-sixteenths of an inch thick; and the cost would be about 3*l.* per 100 cubic feet for air reservoirs of this construction.

The reading of the preceding Paper led to the following remarks:—

Mr. Buckle observed, that he had frequently seen this lift at the works of Mr. Gibbons, and could bear testimony to its smooth and exact working and its uniform motion. He was of opinion it might be usefully applied to a variety of purposes, as it was undoubtedly the best description of lift that he was acquainted with for its present purpose.

The Chairman (Mr. Beyer) said, it appeared to him to be a very simple and efficient mode of raising the materials.

Mr. Cochrane observed, that a similar lift was employed at his iron works, for which he had been indebted to Mr. Gibbons; it had proved entirely satisfactory, and there had never been any accident with it.

Mr. Gibbons remarked, that his object in bring the lift before the institution, was to render it more generally useful; for in his opinion it might be advantageously applied to a great variety of purposes, more especially at railway stations and in the docks. It would be a great convenience for raising and lowering trucks, and for loading or discharging vessels; as the platform could be quickly raised or lowered to any exact level, and could be stopped at any point at pleasure without concussion, and held quite firm in the position without any danger of falling, as long as might be required.

Mr. Slate thought it was applicable to lifting railway waggons; and considered that a small blowing engine might be advantageously employed for the purpose, working at a much quicker rate than usual, even 700 feet per minute, like the pistons of locomotive engines; the leakage of the piston would then be of much less consequence.

Mr. Cowper suggested that steam might be available for the purpose of raising the lift where there was not a blowing engine at work; for although there would be a loss of steam by condensation on the surface of the water, that loss would be very small compared to the whole quantity of steam employed, as the surface of the water would become quickly heated by the steam, but the heat would only extend very slowly downwards in the water.

Mr. Gibbons remarked, that he considered there would be a difficulty in applying steam, from the difficulty of keeping the joints steam-tight.

Mr. M'Connell referred to the use of hydraulic cranes which had been introduced at some railway stations and other places; and observed that it appeared to involve the question of the relative cost and advantage of air and water as the means for communicating the power.

Mr. Gibbons observed, that the pistons necessarily used in hydraulic cranes were

liable to get out of order, and were a source of expense and trouble, and there was also a considerable loss of power from friction, which was not the case in the pneumatic lift. He thought that by the latter plan a whole railway train might be raised a considerable height, without the motion being felt by the passengers.

SIR SAMUEL BENTHAM'S VERMICULAR BARGES, AND NAVIGATION OF THE RIVERS OF INDIA.

Fig. 1.

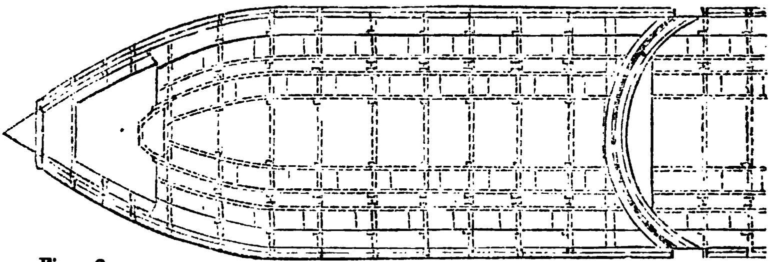


Fig. 2.

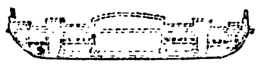
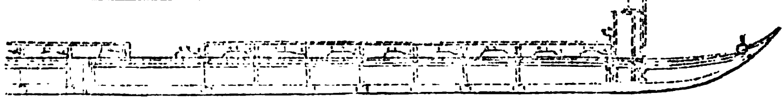


Fig. 3.



It was an erroneous observation (*Mechanics' Magazine*, No. 1330,) that Sir Samuel Bentham's invention of a serpentine or vermicular barge might "be considered more in the light of a curiosity than as an invention of general utility," for already that invention is likely to render the secondary rivers of India available for steam navigation. The *Illustrated News* on the 11th inst., gave a short account of a proposition lately submitted to the East India Company by Mr. Bourne. This gentleman proposes to construct for conveyance of passengers, and for purposes of commerce in India, "a series of barges articulated to one another like a hinge, so as to be able to bend, if necessary, in passing curves in the river;" exactly what was performed by Sir Samuel's barges on Russian rivers. It farther appears by the article in the *Illustrated News* that, besides sinuosities in Indian rivers, the navigation of them is further impeded by banks of hard ground. To enable barks to go over them, Mr. Bourne has rendered his vessels *amphibious* by putting wheels to them, as there were to Sir Samuel's amphibious carriages noticed in the *Mechanics' Magazine*, No. 1351; but Mr. Bourne has devised the great improvement of providing means for raising the wheels out of water when the use of them is not necessary. Shallow draught of water is proposed also for Mr. Bourne's vessels; the channels in Indian rivers admit of more than the double of the six inches which the *Imperial Vermicular* drew when loaded. Mr. Bourne's barks are to be propelled by steam power; considering how much their success will depend on the avoidance of all unnecessary weight, there is another of Sir Samuel's inventions that seems applicable to the barks in question, that of *wooden* boilers for the steam engines.— See *Mechanics' Magazine*, No. 1150, Aug. 23, 1845.

The above-mentioned of Sir Samuel's inventions thus becoming of much interest as to our possessions in India, there is annexed to the communication a copy from the original draught of the *Impe-*

rial Vermicular. This copy (fig. 1) is confined to the head link of the bark, and a part of the second link, as that is sufficient to show the form given to the ends of all the several links. There is added a transverse section (fig. 2) of a middle link, and a longitudinal section (fig. 3) of the head link.

The *Imperial Vermicular* consisted of six links, each of these 42 feet long. Total length 252 feet. Exterior breadth of the middle links 16 feet 9 in. Interior clear breadth of the habitable part 13 feet 5 in.

The application to Indian navigation of the vermicular principle of barges, and of rendering them amphibious, affords one of the many instances in which the *Mechanics' Magazine* has rendered essential service, for it may be presumed that the *Imperial Vermicular* and the amphibious carriages of Sir Samuel have suggested the idea of putting these inventions to extensive use in the shallow and tortuous rivers of India.

BALL'S IMPROVED WATCH.

(Registered under the Act for the Protection of Articles of Utility. Thomas Banbury Randle Ball, of Hill-street, Coventry, Watch Manufacturer, Proprietor.)

Fig. 1.

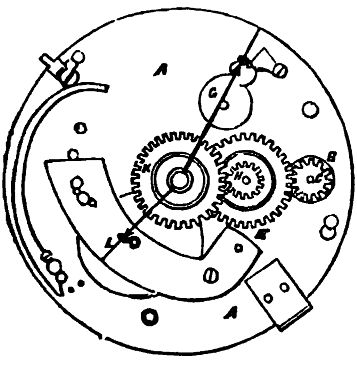


Fig. 2.

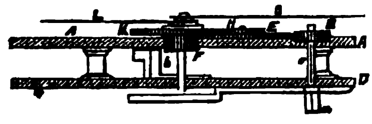


Fig. 1 of the above engravings is a plan, and fig. 2 a section of so much of a watch as is necessary to show the new configuration. A is the pillar-plate; B, a small pinion of twelve teeth, centred upon the spindle, C, which projects beyond the top-plate, D, and terminates with a square end, *a*, in order that an ordinary watch-key may be adapted to it for facility of turning. E is the minute wheel, into which the pinion, B, gears, and which, in its turn, takes into the cannon pinion, F, keyed upon the spindle, *b*, having attached to its upper end the minute hand, G; H is another pinion, made in a piece with the minute wheel, E, and turning upon the same centre, the teeth of which gear into those of the hour wheel, K, the hollow axis of which freely revolves around the spindle, *b*, and has attached to it the hour hand, L. By means of the addition of the pinion, B, the setting of the hands can be accomplished from the back in a similar manner to the winding up of the watch, so that there will be no occasion for opening the glass covering the face; and the spindle, *b*, can be considerably shortened, and allow of a much flatter glass being used, thereby materially reducing the thickness of the watch.

PLAN TO PREVENT ACCIDENTS THROUGH EXPLOSIONS IN MINES.

Sir,—The enclosed plan for the prevention of accidents through explosions in mines, depending upon the power of transmission to a distance of the electric spark, has been considered by some acquainted with general science as likely to succeed. There is no doubt of the efficiency of the principle, but the plan, as at present proposed, will perhaps need some alteration for adaptation to efficient results. For this purpose, the opinions of those connected with mines and mechanical science would be very desirable, and an insertion in your Magazine of its details, as at present suggested, would perhaps elicit such observations as might lead to success.

Let there be an electrical machine, with battery near the bottom of the shaft.

Let there be wires, cased with gutta percha, proportioned to the size of the mine. For purposes of extension or diminution, let them have platinum points at one end, and platinum sheaths at the

other, thus rendering them shorter or longer at pleasure.

Let there be staples for conducting the wires to any part of the mine. The walls being easily pierced, these could be put up or taken down, as required.

Let there be an electrician constantly in attendance to observe the workings, the state of the atmosphere in the mine, and to set the electricity in action, if required.

Upon an appearance of the fire-damp to any extent, let the men be withdrawn. Let the electrician, under the protection of the safety lamp, conduct the wires to the place where the fire-damp has appeared, and pass from the machine, at the base of the shaft, sparks through the inflammable gas, and explode it,—himself, and all else, being at a sufficient distance, and safe.

Note 1st. The electrician would not be an expensive official; for his knowledge of electricity and science in general, with perfect efficiency for the object in view, need be very limited.

2nd. With the apparatus here proposed constantly in readiness and duly used, there would be no accumulations of fire-damp, and consequently no explosions of magnitude.

3rd. The constant *vacua* produced by this plan would improve ventilation in the mine.

4th. The best ventilation would still be needed (supposing the above plan in action, and perfectly efficient for the prevention of the danger of explosion), to keep the atmosphere in good condition for respiration, and to obviate the accumulation of noxious gases as much as possible. Ventilation by itself, however, has always been found, and probably always will be found, insufficient to prevent accidents through explosions of fire-damp. I am, Sir, yours, &c.,

B——.

Sept. 1, 1849.

WALKER'S EFFLUVIA-TRAP FOR SEWERS AND WATER-CLOSETS.

[Registered under the Act for the Protection of Articles of Utility. John Walker, of 48, Shoe-lane, London, Builder, Proprietor.]

Fig. 1.

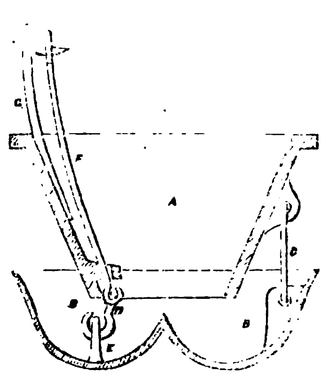
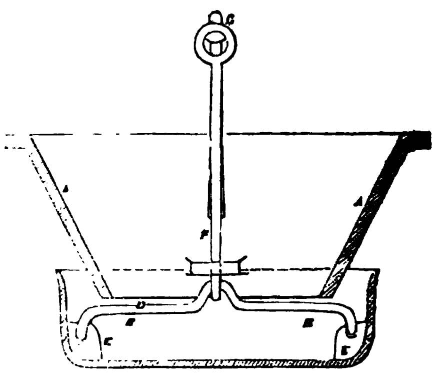


Fig. 2.



This effluvia trap is an improvement on the one previously registered by Mr. Walker. It requires less attention than the original trap, and is intended to remove certain trifling defects in its construction, pointed out by Mr. Hayward, the City Surveyor of Sewers.

Fig. 1, is a cross section of this trap, and fig. 2, is a longitudinal section; the section in both cases being taken through the centre. A A, is the frame; B B, the basin, or pan, which is suspended from the frame by the links, C C, only one of which is seen in the engraving; D, is another bent link which is connected at its ends to the basin by the

links, E E, and at its centre joined by an eye to the rod, F; when the basin is in use, the upper end of the rod, F, is hooked upon the support, G, and in that position the basin will always retain a sufficient quantity of water to seal the opening, so that no effluvia can pass up through the trap, I. If mud, or filth, should accumulate in the basin, all that is required to clean it is to unhook the rod, F, when the basin will drop down and clear itself.

We understand that Mr. Walker's traps are now being placed in Fleet-street and other parts of the City, by order of the Commissioners of Sewers.

THE BRITANNIA TUBULAR BRIDGE.

Sir,—Will you oblige me with space in your valuable Journal for a few remarks with reference to that unique undertaking, the great "tubular bridge?"

I have no doubt the readers of your useful pages would, with myself, regret the accident to the great hydraulic press, and the consequent delay of the consummation of that stupendous undertaking.

That the means used for raising the tubes are quite adequate to the task assigned, I think no one acquainted with mechanics will doubt for a moment; but now there is just ground to fear that a similar misfortune may befall a second or third cylinder, which of course would greatly retard the work.

I feel sure that the worthy son of the great George Stephenson will pardon a humble individual for suggesting that the four great tubes might be safely placed in their respective destinations before it is possible to have the hydraulic cylinder replaced, viz., by means of tidal power.

The plan I propose is to place pontoons or dismasted ships under the ends of the tube at low water, on which suitable scaffolding abutting under the tube should be erected; it will be evident that as the tide flows the tube would rise. If we reckon the difference between low water and high water at 20 feet, and allow 5 feet for extra draught of pontoons or ships, from the burden of the tube, it would give 15 feet per tide; 15 feet being added to the scaffolding or abutment at low water, another lift might be taken, and so on, until the tube reached the desired elevation.

By this means the great expense of constructing and elevating the huge hydraulic presses, two 40-horses power steam-engines, the suspension chains, lifting frames, &c., would have been obviated.

Tidal power might have been used to work the presses as easily and readily as a steam engine could be applied, and an almost unlimited amount of power might have been brought to bear, either for lifting the tubes or working the presses.

I would advise the two parallel tubes to be lifted at one operation, for three reasons—economy in constructing the intermediate scaffolding or abutments, superior proportions of scaffolding, and great saving of time. Suppose the two tubes to weigh 4,000 tons, if a buoyant power equal to 6,000 tons is applied to them, they would ascend as naturally as a spark flies upwards. Had the ends of the tubes been temporarily filled-in, they would have floated buoyantly on the water to the desired spot, and with the aid of two steam tugs might have been manœuvred into the grooves in the piers; dispensing altogether with the pontoons.

In conclusion, I would beg to suggest the practicability of constructing the tubes on a tramway, at the desired elevation, on either shore, and in a right line with the intended bridge; uniting in one the two centre tubes and one land tube—in all, 1,180 feet. I think it will be clear that, with the aid of three or four locomotives, the tube might be propelled upwards of 500 feet across the straits, and considerably beyond the Britannia Pier, before it lost its equilibrium, and by weighting the end on *terra firma*, it might have been pushed three parts of the way across the straits without any pressure on the Britannia Pier, which, of course, would require to have a roller or fixed centres for the tube to run over, and uniting with the land-tube set up on the opposite shore, would complete the whole.

Perhaps it would be requisite to make use of suspension chains, to throw the weight from the ends of the tube on to a tower forming a portion of the tube, and, when permanently fixed, to surmount the Britannia Pier; and then the chains might be transposed, so as to counteract the constant vibration the tubes will be exposed to.

Yours respectfully,

JOSEPH FAULDING.

11, Edward-street, Hampstead-road.

LAW OF PATENTS.—REPORT OF THE COMMITTEE ON THE SIGNET AND PRIVY SEAL OFFICES.

Extracts from Minutes of Evidence.

(Continued from page 209.)

Thomas Webster, Esq., Examined:

In case of opposition at the Great Seal, does a public hearing take place before the Lord Chancellor?—Yes, a public hearing on affidavits before the Lord Chancellor.

An ordinary hearing in Court?—Yes.

Do many oppositions take place at that stage?—There have been several recently. I have been concerned in five or six during as many years. There have been two or three in this last year.

One of the witnesses whom the Committee have examined has advised that the proceedings before the Lord Chancellor should be discontinued. Do you concur in that opinion?—No; I do not think you can possibly do that, unless you change the whole principle of the granting of letters patent, because the Lord Chancellor is the party to affix the Great Seal. So long as the theory of the patent deriving its whole force from the Great Seal continues, it is a matter of discretion in the Crown to do that. The Lord Chancellor, as the last adviser of the Crown, certainly ought to have the option of refusing it if he pleases. No doubt it has been resorted to in two or three cases as a matter of harass and delay, and as a means of driving some hard bargains with a party; but that is an evil to which most proceedings may be subject; the unsuccessful party is generally mulcted in the shape of costs. I do not think you can do away with the practice before the Lord Chancellor.

Setting aside the question of form arising from affixing the Great Seal, do you think that any substantial advantage arises from the present proceedings before the Lord Chancellor?—No, I do not.

Do you think it would be sufficient if a patent were granted after one investigation before the Attorney or Solicitor-General?—No. I think there ought to be an opportunity for the parties to come in at a subsequent stage. I am not now saying when the investigation should take place. I think one investigation might be sufficient; but if there is to be an investigation, if the opposition is to take place at so early a stage as it does at present, before the public have the means of notice of what is going on, I think there must be an opportunity for subsequent investigation. If a proper system of advertisement were adopted, then one investigation at a later stage, the party having protection from the time of presenting his petition at the Home-office, would be sufficient.

Assuming the alteration that you have suggested, with respect to the notices at the first stage, were made, do you think that one investigation by the Attorney-General would be sufficient, and that the patent might then be granted?—Yes; I think it might be. But then I think that the investigation before the Attorney-General should be of a more public and different character than it is at present.

At present there are three substantial stages of investigation, at the Report, at the Patent Bill, and at the Great Seal?—Yes.

Do you see any advantage in those three distinct stages?—I am satisfied that it is one too many. I am sure that one might be done away with advantage. If the first investigation is to take place, that is, at the early stage before the Attorney-General, and to be conducted without any proper system of notice, you must have a subsequent investigation, when the public may come in.

Supposing a proper system of notice were established prior to the investigation at the first stage, do you see any advantage in the second stage?—None whatever.

Has not your doubt as to the expediency of abolishing the second stage arisen from what you conceive to be the defective nature of the notice at the first stage?—Clearly so.

If the defects at the first stage of the investigation were cured, would not then the investigation at the second stage be unnecessary?—Yes, and certainly impolitic. I look upon it that a thorough reform of the system, so that you might have one good notice to the public, and a thorough investigation at a latter stage, whether by the Attorney-General or any other party, would be far better than the present system. There can be no earthly use in two investigations.

That investigation, of course, ought to be as late as possible?—Yes.

I understand your opinion to be, that no tribunal, preferable to that of the Attorney or Solicitor-General can be devised for the investigation of applications made to the Crown for the grant of patents?—I would not say that no better tribunal could be devised, because I think, looking at the engagements and the continually changing nature of the Attorney or Solicitor-General, and other law officers, that if that is to be the only tribunal, and without assistance, it is a very bad one, and must continue to be so. If you make that the tribunal, the Attorney-General and the Solicitor-General ought to be provided with some permanent assessor or commissioner, who would have a continuous existence from one officer to another. I look upon it as one of the greatest abuses of the present system, that on every change of officer the papers are bundled over to his clerk, a number of most important documents, deposits and caveats, and the whole machinery of the office, is turned over, at twenty-four hours' notice, to a clerk who probably never saw anything of the business before, and is wholly unacquainted both with legal and scientific ques-

tions. I think a much better tribunal might be adopted, in aid either of the Attorney-General or the Lord Chancellor, or any party whom you might fix upon.

Your view seems to be that the Home-office ought to refer the application to a permanent legal authority, whose principal duty it should be to report upon questions of patents?—Yes; I think that you should have one or two qualified officers, who should be either attached to the Home-office, or to the Attorney or Solicitor-General, or to the Patent-office, if it were thought expedient to have a distinct officer, who might advise the authority with whom the ultimate decision of granting patents rested.

Would there be any advantage in creating an assessor to the Attorney-General, rather than creating an independent authority, to whom the Home-office could refer?—I think he would do as well as a more independent authority, but then you must change the system entirely. I have been discussing the matter, to see how you could mend the present practice, keeping in view the leading features with reference to the law-officer's advising the Crown, and the grant issuing upon his advice. If you enter into the question whether the whole system cannot be changed for a better, that is a very large question, which I am not prepared at this moment to go into, but which presents itself in a very different aspect to what I have already said. The opinions which I have given are principally directed to how you could deal with the present system, retaining its main features.

The Lord Chancellor being now the person to affix the Great Seal, could you call upon him to seal an instrument without hearing any objections that there might be to his sealing it, making it a mere ministerial act?—I do not think you could. We must change the whole system entirely; but I think that you might preserve the leading features (and that is always desirable in legislating, if you can) of the system, altering a great number of the practical details. But I think, as an essential to that, you ought to have at the Home-office, or the Attorney-General ought to have, some two or three competent persons as assessors or advisers, whose duty it should be to see that the business was properly conducted, and who might advise him, and advise each successive Attorney-General, as to what should be done. I would really suggest to the Committee to apply to some gentlemen who have been Attorney and Solicitor-Generals, Mr. Baron Rolfe, for instance, as to the difficulties I have heard him speak of, coming, as he did, very fresh to the practice, and as to the trouble he was very often subjected to, being a most conscientious man, and determined to investigate everything thoroughly. I know very well that they must find extreme difficulty in dealing with the statements of scientific men, whose interest it may be to conceal the real features of the invention, in order to avoid anticipated opposition, or to get as general a deposit as possible.

Might not the affixing the Great Seal to a patent for a new invention be made by an Act of Parliament a merely ministerial act?—There is no reason why you should change the thing entirely, and pass an Act to say, certain things have been done, that a person shall have a patent. I am not inclined to advocate so great a change. I do not see the advantage of so great a change as that. I think the great attempts that have been made (and great attempts have been made, and much money spent, by people at Manchester and Birmingham to get some changes made), have failed by reason of attempting too much. I do not see any objection, the theory being that the validity of force of the grant flows from the Great Seal, if the Lord Chancellor affix the Great Seal, that he or any one that he calls in, like the Attorney-General or the Master of the Rolls, ought to have the power of hearing an opposition, and the public ought to have the power of being heard at that last tribunal.

In all cases where the Great Seal is affixed to a patent, is the Lord Chancellor supposed in law to exercise a discretion?—Certainly.

In cases of appointments, is the Lord Chancellor supposed to exercise a discretion?—I do not know at all. You will find what the Lord Chancellor and the Master of the Rolls are supposed to do fully stated in the case of Nickel's Patent, page 662 of my Patent Cases.

. . . .

Do you consider that any other change in the mode of enrolling specifications is requisite?—I think that a very great change in the practice of the office, and which I hope the Master of the Rolls will introduce, will be made. It is a great hardship upon inventors at present; they have no means of knowing the inventions for which patents are granted, and yet an inventor is, in point of law, bound to know everything for which a prior patent has been granted, but he has no means of ascertaining it. If he gets to the offices, there are no classified indices of subjects. The specifications having been brought to one office, I hope funds will be found to make proper indices, and that parties will be able to consult specifications at one place. I think that some little change in the practice of giving back a specification

to a party might be made with advantage; that the specification deposited might be kept, and a copy made, which parties might consult, and they might be bound by their original document rather than by the office copy. The consequence is, that it sometimes turns out that the specification has been improperly copied, and the patentee has no means of checking it. If he goes and reads over his enrolment, then he may find it out; but he ought not to be required to do that. He takes in a parchment paper and drawing sealed by himself, and I think that that ought to be kept, and that the document which the public consult should be a copy of that.

Is that original not kept anywhere?—No, that is returned to him; and the consequence is, when any question arises as to his having done properly everything he can to comply with the proviso, he is bound by the office copy which the officer has made; the copy in his possession is not evidence, because coming out of his custody he may have altered it; I think that requires alteration.

The change to make there would be to enrol the original instrument, and give the party a certified copy?—Yes. The practice as regards wills is a good one to follow: the original will is kept, and is copied into a book; the public consult the copy, but with regard to the specification, the original given back to the party is of no use to him whatever.

Is there not a difference in the period allowed for specifications in England and in Scotland?—Yes; and that is a matter of practice which ought certainly to be taken into consideration. If a party presenting his petition says that he means to apply for a patent for England only, then he has two months for specifying; if he inserts in his petition his intention to apply for a patent for Scotland and Ireland, he has six months. It sometimes happens that, supposing he applies for all the patents together, from accident that the Scotch patent is sealed first; that occurred in a case which was brought under my notice only yesterday: a specification was brought to me, in which it happened that in his Scotch patent he had only four months to specify; he would then have to enrol his specification in Scotland, and thus make a publication of the invention two months previously to the publication in England. If there were a patent running in England for the same invention, but of a prior date to the Scotch patent, a party might steal the invention from the specification published in Scotland, as was alleged to have been done in one recently before the Lord Chancellor; thus a stranger might put into his English patent, of a prior date, information that he got from the Scotch patent of another person. Then, as the specification relates back to the date of the patent, the stranger so introducing the invention into his patent is the first inventor in England; and he not only has the whole right in England, but the right under the Scotch patent is gone by reason of there being a prior patent in England, upon the authority of Brown *v.* Annandale. All these mischiefs have grown up from the adoption of a system which it was never intended to apply to patents for inventions.

That evil has also arisen from the different systems adopted for the three kingdoms?—Yes

. . . .

Reverting to a former question, does it not seem desirable that if a person does not prosecute his patent to completion within a certain time, the application should be considered void?—Yes. I would cure that practically in this way, by having the patent sealed from the date of presenting the petition at the Home-office. A person ought not to make a declaration till he is *bonâ fide* in possession of the invention. At such a stage or degree of maturity his patent should bear date, and the patentee should have protection from the time of presenting the petition; that would prevent him from presenting a petition for the purposes of delay. A month would be of little consequence, if he used it for delay. Twelve months would shorten his time by a fourteenth; it would also impede it. It has been said that a patent has been delayed at particular offices by reason of the parties connected with those offices being connected with and soliciting patents for rival patentees; that would be cured if at the Home-office, or some other office, applications were registered in order, and the patents dated according to the day on which those applications came in.

(*To be concluded in our next.*)

IRON WAREHOUSES FOR SAN FRANCISCO.

"We saw the other day some of the admirable iron cottages about to be sent out to 'the diggins,' so that while scratching the earth for its surface gold, the diggers may have a shelter over their heads from the rains and winds of heaven,—a home in the wilderness. Messrs. E. T. Bellhouse and Co., of the Eagle Foundry, in this town, are just completing an order for four of these dwellings for a shipping firm in Liverpool, and which are to be sent forthwith to San Francisco, to be forwarded thence inland to the diggings. One of these cottages, complete, stands in the yard of the Eagle Foundry, and we briefly de-

scribe its appearance and dimensions:—It is 20 feet long by 10 feet wide; the roof is elliptically arched, having a spring of about 18 inches in the width of 10 feet. One cottage was made with a pitched roof, but the arch is preferred. The inside height of the house is 7 feet 6 inches from the floor to the spring, and 9 feet to the centre of the arch. Internally, the house comprises two rooms; the 'house part,' or day room, 12 feet 6 inches by 10 feet; and the bedroom, 7 feet 6 inches by 10 feet. The cottage has one outer door into the day room, an inner door between the rooms, and a window in each room. In each gable wall, within the arched portion, are four circular holes, for ventilation, so that when open at both ends, and the inner door is also open, a current of air can pass through the house. The windows have also an opening by swivel and rack, like those in our factories. The whole fabric is of iron; the walls and roof of wrought iron plates, one-eighth of an inch thick, and averaging about 5 feet by 2 feet 6 inches; these are framed on angle iron and T iron uprights, each plate numbered so as to fit into its own place, and all are fastened together, without rivets, by bolts and nuts only. Externally, there are three uprights on each side; these are of hollow roll iron, which, being filled with wood, can have screwed to them inside a wooden lining, which is being applied to two of the cottages about to be sent out. The roof eaves project about 8 inches, so as to keep the rain off, and the whole structure is so compactly fitted, as to be perfectly water-tight. The external walls rest on a foundation of balks of timber, upon which are laid iron bases, forming a moulding on the outside, which prevents the water from settling there, and at the same time gives a finished appearance to the house. There is no flooring provided, it being intended that the floor shall be levelled on the spot, and either made of puddled clay, or of boards, at the choice of the settler. The doors are simple frames of wrought iron, covered with sheets of iron, and having lock and latch. Each window is 3 feet deep by 2 feet 4 inches wide; the framework is wholly of cast-iron, containing sixteen panes, of which the four centre ones open on a swivel, with a segmental rack for setting it open at three different angles, very similar to those in cotton factories. The windows will all be glazed when the house is erected, the glass being fitted and sent out in a separate package, so as to prevent breakage. The windows have each two external shutters of wrought iron, framed like the doors; these shutters are secured by a transverse iron bar outside, fastened inside by a bolt and cotter. Each house is provided with a neat and useful stove for warmth and culinary purposes. It is like a chest, 2 feet by 1 foot, and 12 or 15 inches deep, of cast-iron, supported on a frame of wrought-iron. This stove in hot weather may be set up outside the house, or it may be placed in the house part nearly opposite the outer door, its funnel passing through the wall at the back of the stove. The sides and back of the stove inside are lined with firebricks; the half of its floor next the door is grated, so as to admit a current of air when the door is closed. The top is a loose flat lid, with two central apertures, covered by lids, which remove and give place to a pan or cauldron; but, with good management, the contents of any pan placed on the smooth iron surface of the lid will be heated with due rapidity. The ventilating holes are in pairs, with a broad band of iron on a pivot between each pair; this band when vertical leaves the holes open, but when horizontal covers them. In the bedroom there is a width of 5 feet between the inner door and the back wall, giving ample width for a bedstead, or hammock slung across, to the extent of 7 feet 6 inches from head to foot. The weight of iron in one of these houses is about 2½ tons; and one such cottage costs (unlined) about 60*l.*; if lined with wood about 10*l.* more. The two last built have each been entirely constructed in a week. It is calculated that three or four men can take one of these dwellings down in one day, and put it together in three or four days. These iron dwellings, varied somewhat in form and construction, are commodious fishing or shooting-boxes; or for out-houses, stabling, shippons, piggeries, &c., where a tenant needs such erections, and does not wish to build on his landlord's land substantial edifices, which become part of the freehold. These he can take to pieces and remove when he quits; and we understand that Messrs. Bellhouse and Co. have had applications for similar erections for such purposes. They also built, some time since, two iron warehouses, one 60 feet by 24 feet, and the other 40 feet by 20 feet, which are now at San Francisco; but these they constructed at Liverpool. We have never seen iron dwellings uniting so many comforts and conveniences, with such simplicity of construction, stability, and strength."

MR. CROSLEY'S PATENT.—ABSTRACT OF CLAIMS.

Henry Crosley, of the firm of H. Crosley, Son, and Galsworthy, of Emerson-street, Surrey, engineers and coppersmiths.

For certain improved modes or methods of, and apparatus for, heating and lighting, for drying substances, and for employing air in a warm or cold state for manufacturing purposes. Patent dated February 28, 1849.

Claims.—1. An apparatus for heating water and other fluids.

2. A method of constructing boiler and other furnaces with rows of pillars of fire-brick, two, three, or more placed immediately behind the fire-bars, and with air passages leading from the top of the brickwork to beneath the fire-bars.

3. A method of generating steam of low pressure by the application of steam of high pressure, as also a self-condensing box used in connection therewith.

4. A method of heating sugar pans by means of a moveable furnace mounted on wheels.

5. A gas-heating stove, in the peculiar arrangement and combination of parts of which the same consists.

6. A gas-exhausting apparatus, in so far as regards the employment of two valved pipes or compartments, one for the inlet and the other for the outlet of the gas, such pipes or compartments being within a vessel immersed in water, and the vessel covered over at top by an inverted vessel; and in so far also as regards the mode of occasionally closing the said pipes or compartments at their lower ends by columns of water or cocks, for the application of certain parts to the said apparatus, and to other apparatus partaking of the same nature, and to measuring and registering the gas which passes through it.

7. A governor used in connection with the apparatus last described, and also the application thereof to gas-exhausters generally.

8. Three rotary or wheel gas-exhausters, each in the peculiar arrangement and construction of parts of which the same consists.

9. A moveable or divergent gas stove, in so far as regards the construction of means by which the light and heat generated by the combustion of the gas may be directed to and concentrated upon any particular part or parts of an apartment.

10. A divergent coal fire stove, and also a revolving coal fire stove, with revolving reflector or shield.

11. A "Concentric Gas-burner," and "Conical Concentric Gas-burner," each in the peculiar arrangement and construction of parts of which it consists.

12. A gas-burner, in so far as regards the employment therein of jet pipes (two, three, four, or more,) so shaped and placed, that the streams of gas issuing therefrom shall be ejected obliquely towards the centre of the burner, and impinge against or run into one another; and also of a bottom shade closed against any access of air from beneath (the usual glass chimney being dispensed with). And farther, the application of the close-bottom shade to all other gas-burners to which the same may be applicable. And also a certain modification of the burner.

13. Three peculiar gas-burners described in the specification, in so far as regards the means provided in each for diminishing or enlarging the aperture through which the gas escapes.

14. A candle, which is denominated "Argand," and also an "Argand Candle-lamp," in so far as regards therein the combination of a hollow wick with apertures in the basement for the admission of air into such wick. And also the employment in candles generally of hollow wicks made of vegetable fibrous materials, intertwined or otherwise combined with threads or filaments of zinc or other soft metal or metallic compounds.

15. An improved whirling apparatus for drying substances, in so far as regards the means therein employed to give a reciprocating rotary motion to the hollow cylinder; that is to say, a rotary motion first in one direction and then in another.

16. Several methods of applying air in a warm or cold state for manufacturing purposes, each in the peculiar arrangement, combination, and adaptation of parts of which it consists; and also improvements in an air wheel, formerly patented by Mr. Crosley.

17. The application of the improved air-wheel to the purification of coal gas.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 6TH OF SEPTEMBER, 1849.

EDWARD WESTHEAD, of Manchester, manufacturer. *For certain improvements in the manufacture of waddings.* Patent dated March 3, 1849.

These improvements consist in the introducing of threads, or of some thin woven fabric, so as to form a basis, or durable backing to wadding. The threads or fabric are applied just previous to the sizing. The patentee also proposes (although he does not recommend) the use of gutta percha, to be employed instead of size for the backs of waddings.

Claim.—The introduction of a series of threads, or of a thin woven fabric, into the body of wadding, so as to form a back; and also the employment of gutta percha for this purpose.

William Henry Balmain and Edward Andrew Parnell, both of St. Helen's, Lancaster, manufacturing chemists. *For improvements in the manufacture of glass, and in the preparation of certain materials to be used therein, parts of which improvements are also applicable to the manufacture of alkalies.* Patent dated March 5, 1849.

These improvements relate to the mixture and preparation of materials for the formation of glass.

One mode of preparing the materials consists in heating the sulphate of soda or the sulphate of potass, or the sulphate of barytes, together with sand and carbonaceous matter, and maintaining the whole at such a degree of heat as shall cause them to combine and form the silicates of the different bases.

The chief feature of the other mixtures is the use of deoxydizing agents, so that the sulphates may be used in making glass. The sulphates do not act destructively upon the pot, and are much cheaper than the carbonates.

Another improvement is in the use of a furnace of a particular description, for alkalies and silicates. The raw material is thrown on an inclined bed at the further end of the furnace, and, as it melts, runs down to the bottom of the incline, where there is an opening through which it flows into moulds, or into a vessel containing water.

These improvements constitute the subject matter of the claims.

William Henry Green, of Basinghall-street, London, gentleman. *For improvements in the preparation of fuel.* Patent dated March 5, 1849.

These improvements consist—

1. In the construction of a chamber for drying peat. The chamber is charged with peat from the top, till it is nearly full. Under the floor there are a series of flues, heated by two furnaces, and within the flues there are a number of upright iron pipes, these pipes have no internal communication with the flues, but are open at bottom to the external atmosphere, and at top to the drying chamber; the air in the tubes is heated by the flues, and the hot air passing through the peat absorbs all moisture therefrom.

2. In the construction of ovens for coking peat. The dried peat is placed in baskets made of iron hoop, and put into the coking oven; the gas evolved in the process of coking is conducted from the ovens or retorts into a cold-water tank, or condenser, where the products capable of condensation are partly condensed, the residue, escaping by a pipe (through which a stream of cold water runs) into the tank, is still further condensed, and the remaining gas is then discharged into the furnace, where it assists in heating the coke ovens.

Claims.—1. The drying-chamber, as described.

2. The method of arranging ovens or retorts for coking peat.

Nathan Defries, of Grafton-street, Fitzroy-square, C. E., and George Brooks Petit, of Brook-street, New-road, Middlesex, gas engineer. *For improvements in applying gas to heat apparatus containing fluids, and in heating and ventilating buildings; also improvements in gas fittings, and in apparatus for controlling the passage of gas.* Patent dated March 5, 1849.

Mr. Defries has disclaimed all the above title, excepting—"Improvements in applying gas to heat apparatus containing fluids, and in heating and ventilating buildings."

The first improvement is in the method of applying gas to heat baths. The bath has a double bottom, the upper one plain and the lower corrugated, and, being corrugated, presents a larger surface for the absorption of heat emitted by gas-burners placed below it than if plain.

The second improvement consists in applying the heat evolved from gas lights, when used for illuminating purposes, to heating fluids. The heated products of combustion are conveyed by pipes to any convenient spot. Around these are other pipes containing the fluid to be heated, which may be drawn off as required; or it may be made to circulate in pipes for heating apartments.

Claims.—1. The employment of gas, in the manner described, for heating baths.

2. The employment of the heat evolved from gas used for illuminating purposes to heat fluids.

Samuel Banks, of West Leigh, Lancaster, miller. *For certain improvements in mills for grinding wheat and other grain.* Patent dated March 5, 1849.

These improvements relate:—1. To a method of introducing cold air between millstones, to keep them from heating while grinding; and 2. To a method of separating the flour from the current of air after having passed through the stones.

The cooling of the stones is effected by means of a horizontal fan or series of blades affixed to the upper side of the running stone which drive the air into a pipe forming the eye of the stone. The pressure of cold air in the eye causes a current to pass between the stones and keeps them cool. The air thus necessarily gets mixed with the

meal, which must afterwards be separated from it, otherwise a great portion of flour would be lost by being distributed through the mill. To effect this separation, the spout for conducting the meal from the stones terminates at bottom in a flap-valve, which allows the meal only to escape. Into one side of the spout is inserted an upright conical pipe, having the wider end upwards; the air escaping into this pipe expands gradually, until it becomes so rarefied as to be unable to hold the particles of flour in suspension, which, falling into the pipe, enter the spout, and are there collected.

Claims.— 1. The fan-blades, which are affixed to the top of the running stone.

2. The pipe for separating the flour from the air.

JAMES BAIRD, of Gartsherrie, Old Monkland, Lanark, Scotland, iron master; and ALEXANDER WHITELAW, of the same place, manager. *For improvements in the method or process of manufacturing iron.* Patent dated March 7, 1849.

These improvements are in the means employed to heat the air used in the manufacture of hot blast iron. The upper part of the blast furnace is surrounded with a hollow chamber, having free communication with the furnace by means of a number of openings in the brickwork; the pipes for heating the air for the blast are arranged round the hollow chamber, where they are sufficiently exposed to the action of the furnace to produce the requisite heating of the air within them, and yet are sufficiently protected from the direct action of the furnace to prevent their being speedily destroyed.

Claim.—The arrangement described of placing pipes for heating air to be employed in hot-blast furnaces in the arched top of the furnace.

Specification Due, but not Enrolled.

HENRY CONSTANTINE JENNINGS, of Abbey-street, Bermondsey, practical chemist. *For improvements in the manufacture of vehicles for mixing pigments, and also in the manufacture of white lead.* Patent dated March 5, 1849.

NOTES AND NOTICES.

Self-Heating Shot for War Purposes.—We saw, the other day, in the establishment of Mr. Field, tin-plate worker, Argyll-street, a peculiar and apparently most valuable mode of obtaining red-hot shot for large guns. It is the invention of Mr. Scoulier, the foreman in Mr. Field's workshop, and consists in the filling the hollow shot with a highly combustible powder, the composition of which we are not yet at liberty to make public. Two or three fuse-holes are made in the shot, so that, when fired from the piece, ignition takes place, and the shot is made red-hot before it arrives at its destination. In the trial we saw, the shot, which was about 2½ inches diameter, was simply laid on the ground, and the composition was ignited by a light applied, to the fuse-hole. Violent combustion immediately ensued—liquid fire appeared to stream from its three fuse-holes, and the material became quite red-hot in a few seconds. The inventor states that, when fired from a gun, a red heat will be attained in less than 20 seconds from its leaving its mouth. The composition will burn under water. It is easily made, and there is little doubt as to its efficiency for war purposes, in place of the present expensive and troublesome system of heating, the shot being put into a gun in a cold state, as with ordinary solid ball.—*Glasgow Chronicle.*

Pesth Suspension Bridge.—This splendid bridge is generally supposed to have been completely demolished during the recent events of the war operations between the Hungarians and Austrians, but, up to the present time, we are glad to learn, from a correspondent on the spot, no serious damage has been done to the structure. The first retreat the Austrian army was obliged to make from Pesth, the general gave orders for the destruction of the bridge, and 60 cwt. of gunpowder were placed on it, 30 cwts. on each side, or under the chains, with the view of breaking them. Both charges were fired at the same time; the person who superintended the arrangements and fired the charges, was literally dashed in pieces. The effect it produced on the bridge was the breaking down of the road, which consists of transverse cast-iron bearers, to a considerable extent. The vibration of the chains was very great, and continued for some length of time; but after the retreat of the Austrians, the bridge was again repaired. The Hungarians, however, were obliged again to retreat over the bridge, when Dembinski gave orders for its destruction. Mr. Clark, at Pesth, went to Dembinski, and remonstrated with him, and told him that it would be nothing to his credit as a general, to destroy so fine a structure. The general told Mr. Clark that his orders were peremptory, but, after a great deal of negotiation, he consented that some of the bearers should be taken down, and put into boats, and taken down to the Island of Schutt, the boats to be scuttled, and sunk in deep water; this was done. Then came the Russian and Austrian armies, when the bearers were taken up, and the bridge again repaired. Several shots have struck the stone-work in places, but no great damage is done.—*Mining Journal.*

WEEKLY LIST OF NEW ENGLISH PATENTS.

Malcolm Macfarlane, of Thistle-street, Glasgow, coppersmith, for certain improvements in machinery, or apparatus for the drying and finishing of woven fabrics. August 30; six months.

Alexander Haig, of Smith-street, Stepney, engineer, for an improved apparatus for exhausting and driving atmospheric air and other gases, and for giving motion to other machinery. September 6; six months.

Alexander Robert Terry, of Manchester-street, Manchester-square, engineer, for improvements in the manufacture or preparation of firewood. September 6; six months.

Josiah Marshall Heath, of Hanwell, Middlesex, gentleman, for improvements in the manufacture of steel. September 6; six months.

Sir John Macneill, Knight, of Dublin, and Thomas Barry, of Lyons, near Dublin, mechanic, for improvements in locomotive engines, and in the construction of railways. September 6; six months.

John Hosking, of Newcastle-upon-Tyne, engineer, for an improved pavement. September 6; six months.

LIST OF IRISH PATENTS FROM THE 21ST OF JULY, TO THE 21ST OF AUGUST, 1849.

Thomas Robinson, of Leeds, York, flax dresser, for improvements in machinery for breaking, scutching, cutting, hackling, dressing, combing, drawing, roving, spinning, and doubling flax, hemp, tow, wool, silk, and other fibrous substances, and in uniting fibrous substances. August 7; six months.

John Edward Hawkins Payne, of Great Queen-street, Middlesex, coach-lace manufacturer, and Henry William Currie, engineer, in the employ of the said John Edward Hawkins Payne, for improvements in the manufacture of coach-lace, and in other similar looped or cut-pile fabrics. August 7; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Aug. 30	2019	William Satchell	Uppingham	Pump and fire-engine.
,,	2020	Henry Holden	Liverpool-street, King's-cross	Tailors' measure.
Sep. 3	2021	Hilary Nicholas Nissen and George Phillips Parker	Mark-lane	Cash envelope.
4	2022	Andrew Lindsay	Greenock	Spindle bearing.
,,	2023	Andrew Lindsay	Greenock	Spindle bearing.
5	2024	Neale and Wilson	Grantham, Lincoln	Stone-cutting machine.
6	2025	Thomas Stainton and Matthew Stainton	South Shields, Durham, founders and general smiths	Windlass.
,,	2026	Augustus Paul and Brothers	Paris	Needle threader and case.
,,	2027	John Duley	Northampton	An effluvia trap.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1362.] SATURDAY, SEPTEMBER 15, 1849. [Price 3*d.*, Stamped, 4*d.*
Edited by J. C. Robertson, 166, Fleet-street.

THE DISC ENGINE, AS IMPROVED BY MR. BISHOPP.

Fig. 1.

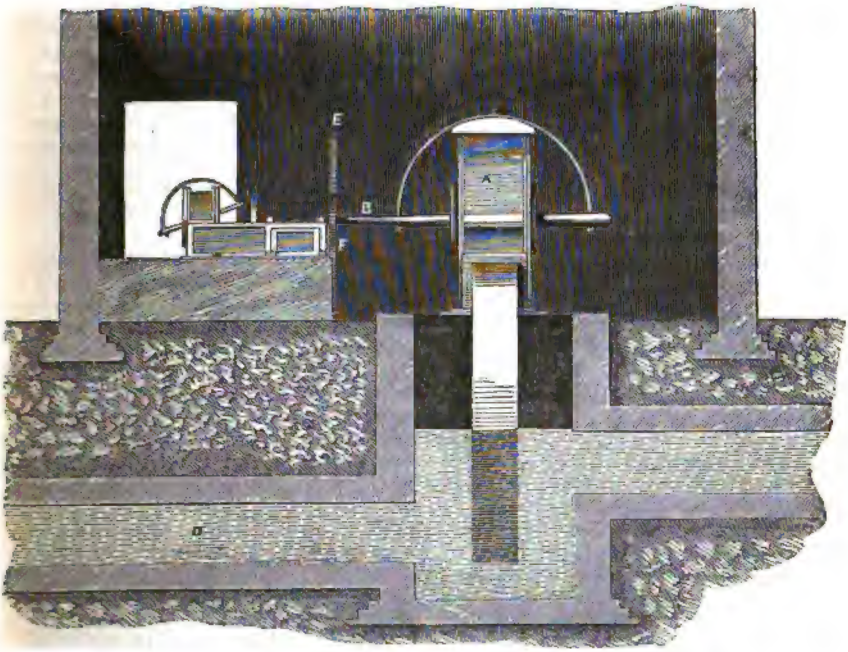
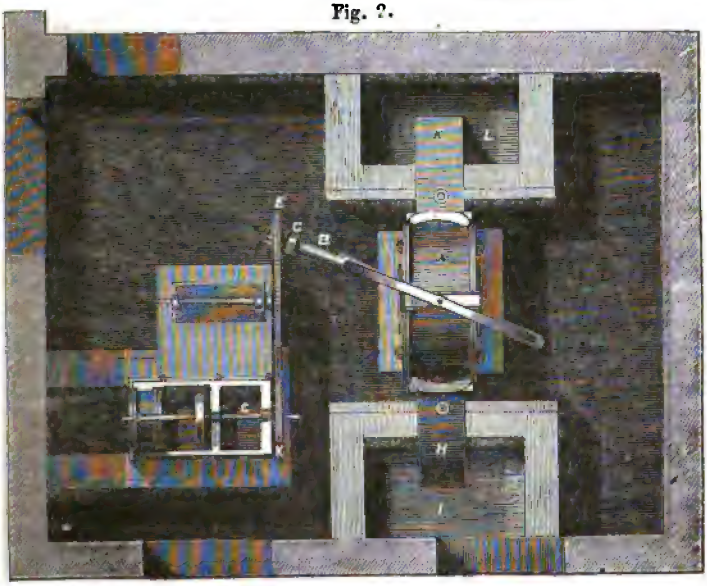


Fig. 2.



THE DISC ENGINE, AS IMPROVED BY MR. BISHOPP.

[When noticing, recently, the disc engine erected at the *Times* Printing-office, and its admirable performances there (as well as elsewhere), we promised to give, on some future occasion, an explanation of these improvements made in it by Mr. Bishopp, by which he has redeemed it from a state of half oblivion and no inconsiderable odium, and raised it once more to a foremost place among the mechanical wonders of the day. Mr. Bishopp himself has since kindly favoured us with an account of his two improved disc engines, which are now in course of construction, for drainage purposes, by the eminent firm of Messrs. Whitworth and Co., of Manchester; and, by giving insertion to it, we shall no doubt render a much more acceptable service to our readers than we could do by any description or remarks of our own.—ED. M. M.]

The accompanying engravings represent a 57-inch disc pump and a 21-inch disc engine, constructed by Messrs. J. Whitworth and Co., of Manchester, on Mr. G. D. Bishopp's improved plan, and now in course of being erected at Patrington, near Hull, to drain an estate under the superintendence of Josiah Parkes, Esq., C. E.

The quantity of water to be lifted will be 12 tons per minute, and the greatest height of the lift will be seven feet.

Fig. 1, represents a side elevation; fig. 2, a plan; and fig. 3, an end view of the engine and pump. The pump, A, is constructed with plain cones and a plain disc; and in order to keep the disc in contact with the cones, the diagonal shaft, B, is driven by a drag-link, C, which takes hold of a pin fixed in the spur-wheel, E; the distance of the centre of the pin from the centre, S, being greater than the radius of the circle described by the end of the diagonal shaft, B.

The spur-wheel, E, is driven by the pinion, F, on the engine-shaft, G; and the relative speeds of the engine and pump are five to one.

The pump has no valves, and the stream delivered is continuous, and not intermittent, although neither a stand-pipe nor an air-vessel is employed. The suction-pipe, H, descends into a well, I, into which the water flows through a culvert, D, from the land reservoir. The culvert, N, leads into a drain, called the Winestead Drain, which leads to the sea, and has a sluice-gate at the end of it, to be opened in summer for the purpose of irrigating the land. The delivery-pipe, K, descends into another well, L, and from the latter a culvert (similar to N) leads into the Winestead Drain. Consequently, the level of the water in the well, I, will always be the same as that in the land reservoir, and the level of the water in the well, L, will be the same as that in the Winestead Drain.

As the stream delivered by the pump is continuous, the water in the delivery-pipe, K, above the level of the water in the well, L, will balance so much of the pressure of the atmosphere as is due to that height; or, in other words, it will balance an equal column of water in the suction-pipe, H. Therefore, the work done by the engine will never be more than that due to the difference of levels in the two wells, which will sometimes be no more than twelve inches, and at other times will be as much as seven feet.

With an ordinary pump, or a scoop-wheel, which is usually employed for raising large volumes of water at a low lift, the power exerted would always be equal to that required to raise the water to a given height; viz., that of the highest level of water ever in the Winestead Drain, or some complicated contrivance must be employed to avoid doing so.

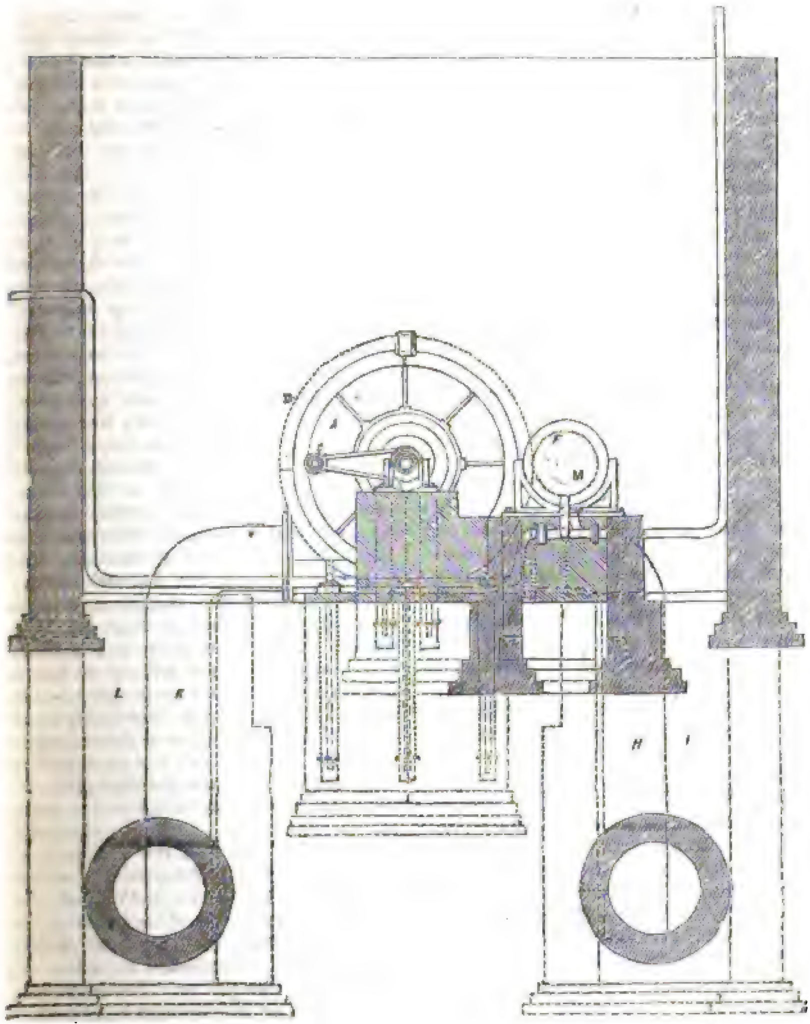
The engine (M) is an 8-horse power high-pressure disc engine, with expansive gearing cutting off at half-stroke, and is constructed with the improvements lately patented by Mr. Bishopp, who has been engaged for some few years past by the patentees of the disc-engine to superintend the construction of their engines.

These improvements may be thus briefly indicated:

Instead of using a disc and cones, with teeth or projections cast on them, a *plain* disc is employed, having parallel sides, and each of the two cones has twenty-two parallel and deep grooves placed in it, into which are fitted slips of metal. These slips project a sufficient distance above the surface of the cones for the disc to touch three of them at once, and

they are held up by spiral springs placed under them. By this arrangement, the former cast-iron patterns, which were expensive and difficult to make, are dispensed with. All the surfaces are turned or planed, and can, when required, be refaced, and the parts likely to wear most rapidly can be separately replaced. The disc, also, can be made of any strength, and, on account of the slips, there is a clearance between the disc and the cones, so that the main shaft no longer requires to be kept perfectly true with the centre of the disc.

Fig. 3.



There are many minor improvements introduced; the chief of which are,—a more perfect method of carrying the ball of the disc by means of glands, by which the hemp-packing is defended, and in the condensing-engines a vacuum of twenty-seven inches constantly maintained; a different parallel motion and method of working expansively; and the ball is made in two pieces, so that it can be refaced or renewed without making a new disc.

G. D. Bishopp.

MATHEMATICAL PERIODICALS.

(Continued from vol. I., p. 565.)

XVII.—*Burrow's Diary.*

Origin. — This periodical probably owed its origin to the successful efforts made by Mr. Carnan, the proprietor, to dispossess the Stationers' Company of the exclusive privilege of printing almanacks, which they had monopolised 170 years. From the article "Almanac" in the *Penny Cyclopædia*, we learn that "James I. granted a monopoly of the trade in almanacs to the Universities and the Stationers' Company, and under their patronage astrology flourished till beyond the middle of the last century, but not altogether unopposed." Swift, it appears, under the immortal name of Bickerstaff, directed the points of his satiric humour so effectually as to stop the mouth of the *original* Partridge, though "he could not destroy the corporation under whose direction the almanac was published;" but in the year 1775, "a blow was struck which demolished the *legal* monopoly. One Thomas Carnan, a bookseller, whose name deserves honourable remembrance, had some years before detected, or presumed the illegality of the exclusive right, and invaded it accordingly. The cause came before the Court of Common Pleas, in the year above-mentioned, and was there decided against the Company. Lord North, in 1779, brought a Bill into the House of Commons to renew and legalise the privilege; but after an able argument by Erskine in favour of the public, the House rejected the ministerial project by a majority of 45. The absurdity, and even indecency, of some of these productions was fully exposed by Erskine; but the defeated monopolists managed to regain the exclusive market, by purchasing the works of their competitors." Mr. Carnan justly prided himself in having been so successful in this "expensive suit in law and equity," and never failed to preface his almanacs with an announcement of the decision. Lord North's attempt to restore the monopoly was also annually noticed, under the head of "Uncommon Notes;" nor did he fail to remind some ungrateful vendors, "to whom they were indebted for the double profit which they had for some years enjoyed from the sale of almanacs."

The first number of this almanac was published under the title of the *Ladies' and Gentlemens' Diary; or, Royal Almanack for the year of our Lord,* 1776: the name was *pluralised* in the three succeeding numbers; but in 1780, the "*gentlemen*" were discarded, and the work was issued under the designation of the *Ladies' Diary*, until its discontinuance in 1788. In the preface to the first number, the editor observes that, "As almanacks are becoming necessary to people in every station of life, and consequently have a more extensive sale than almost any other publication, it is evident that, when founded upon proper plans, and well-conducted, they must be of general utility, and that there can hardly be a *greater public nuisance than one conducted in a contrary* manner." This was too pointed a *hit* for the "*Palladium* author" to pass by unnoticed, and accordingly we find the compliment returned *with interest* in the next number of that notorious work; but as the wary "Captain" chose to cover himself with the shield of a correspondent's name, no notice was taken of this "passage of Arms." The preface further observes, that "the only Almanack that has hitherto appeared on anything like a rational plan is the *Ladies' Diary;* but this performance, though good in its kind, being particularly confined to a number of short questions and answers (and many of these trifling ones), it seldom happened that there was room to treat any useful subjects thoroughly, and never to draw results, or to deduce practical rules from them; the consequence of which was, that many useful dissertations and curious detached pieces were lost for want of an opportunity of making them public, and that the *Diary* contained a number of little articles of which few were curious, and fewer still of any real use." Hence the editor inferred the necessity for the present work, of which the third part "is intended for Dissertations and Essays on Philosophical, Mechanical, or Mathematical subjects." These good intentions were carefully carried out during the publication of the first half-dozen numbers, but at the end of this period most of his ablest correspondents appear to have forsaken him, and subsequently the work became far

inferior to the corresponding portions of the "*Old Ladies' Diary*," which this work at one time was vainly intended to supersede. Indeed, from the whole of that portion which bears the name of Mr. Burrow on the title-page, it is evident that no friendly feeling existed between the editor and Dr. Hutton. The preceding remarks, quoted from the preface, are evidently intended to depreciate that *Ladies' Diary* of which the Doctor was editor; and in several of the earlier mathematical papers (as will hereafter be seen) his mistakes, real or supposed, are pointed out in no very courteous terms: but at the close of the *Diary* for 1781, "*the learned and ingenious Professor Hutton, Esq.*" is openly charged with "*getting* and *keeping*" Mr. Burrow's letters; an accusation which few, perhaps, will be disposed to consider as *literally* true, especially when it is known that, notwithstanding his eminence in geometry, Mr. Burrow was subject to the infirmity of a violent, and, at times, ungovernable temper.

Editor.—Reuben Burrow, Esq., late Assistant-Astronomer at the Royal Observatory; author of "A Restitution of the Geometrical Treatise of Apollonius Pergæus on Inclinations," &c., &c.

Contents.—The usual contents of each number were an improved calendar for the year, with "such Tables as temporary occurrences" rendered "useful or necessary;" new queries, rebusses, enigmas, charades, paradoxes, &c., with answers to those proposed in the preceding year; new mathematical questions and solutions; dissertations and essays on philosophical and mathematical subjects, &c., &c.

Among the queries are found many of an interesting and instructive character, several of which have since, in substance, found their way into works of greater pretensions. The enigmas appear to attain to the full average merit of such productions; and it may be worth observing, that amongst the contributors of this department are frequently found the names of Professors Bonnycastle and Dalby, Reuben Burrow, the editor, and Samuel Rogers. With regard to the last-named gentleman, an esteemed friend (whose suggestions are always important), starts the inquiry, "Can this be the banker of Lombard-street? At the time when 'Samuel Rogers' appeared in *Burrow's Diary*, the poet would be from 17 to 20 years of age. Nothing there done would be miraculous at such an age; but all would show good talent. Those beautiful lines 'To a Tear,' which were published with the first edition of his 'Pleasures of Memory,' bespeak a philosophical accuracy of conception rarely traceable in a poet:—

'The very law that moulds a tear,
And bids it trickle from its source:
That law preserves the earth a sphere,
And guides the planets in their course!'

All this, I grant, is not *positive* evidence, but it removes, at least, all improbability."

To the above suggestion no reasonable objection can be offered; but when we further consider that Mr. Rogers received a most careful private education—became confirmed in his determination to be a poet at the age of nine, after reading Beattie's "Minstrel"—and published his first work, the "Ode to Superstition," at the age of 24, there is nothing improbable in the supposition that the youthful bard amused himself in the interim with composing an enigma, a rebus, a charade, or even a solution to a mathematical or philosophical question; since the greatest authors of those times did not consider it beneath their dignity to scribble in the newspapers, or occupy the "Poet's Corner" in a periodical publication. The "philosophical accuracy of conception" observable in the preceding quotation has many parallels in "The Pleasures of Memory," published by Mr. Rogers in 1792, and were it necessary or desirable to pursue the *reverse* process in order to infer the poet from the philosopher and mathematician, the contributions to this *Diary* would furnish many important and almost conclusive illustrations. A careful examination of all that appears in this publication, together with certain portions of his *earlier* works, has led to the full conviction that "Mr. Samuel Rogers, of London," and the author of "Italy," are *one and the same* individual; and hence (with all probability) we may add one more to those illustrious names whose early efforts have been preserved, and whose aspiring geniuses have been encouraged by these unobtrusive and far too frequently ephemeral productions.

The "Mathematical Essays" constitute a valuable portion of the work; and

the following enumeration will show that several of the geometrical papers especially are well worthy of being reprinted.*

Article I. Of the Equation of Payments. By Mr. Isaac Dalby.

Art. II. Observations and Remarks on Perfect Numbers. By Mr. Reuben Burrow.

*** At the close of this paper are given the following theorems relating to numbers, which are said to have been copied "from the papers of the late William Jones, Esq."

1. "Every prime number above 5, being lessened by 1 or 5, is divisible by 6.

2. "All prime numbers end in 1, 3, 7, or 9.

3. "Every prime is preceded or followed by a multiple of 3.

4. "The sum of the figures which compose prime numbers is not divisible by 3."

Art. III. A new and easy method of placing a zenith sector in the plane of the meridian. By Mr. Reuben Burrow.

Art. IV. A method of finding the length of any curve by means of equidistant ordinates. By Mr. Reuben Burrow.

Art. V. A new and exact method of finding the time and longitude at sea; of very great use to navigators, &c., with remarks. By Mr. Reuben Burrow.

Art. VI. A new and very useful lemma, necessary in constructing geometrical questions relating to the maxima and minima, &c. By Mr. Reuben Burrow.

*** In introducing this subject to the notice of the reader, the author remarks, that "Euclid has demonstrated that the sum of any two sides of a triangle is greater than the third side; and from this proposition Mr. Simpson has solved the very useful problem of finding a point in a line given in position, from whence lines being drawn to two given points, their sums shall be the least; but I do not know that it has ever been shown that *the difference of any two sides of a triangle is less than the third side*, though this is equally true and useful. I shall therefore demonstrate it in the manner that Euclid has done the other, and then deduce a lemma from it similar to that of Mr. Simpson's."

Proposition.

"Let ABC be any triangle; the difference of any two sides AC, AB is less than the third side, BC."

Lemma.

"Let DS be a given line, A and B two given points; it is required to find a point, P, in the line DS, so that AP—PB shall be the greatest."

This paper was reprinted in the *Gentleman's Mathematical Companion* for 1810, and both cases of the proposition have since been treated by Leslie in his *Geometrical Analysis*, B. iii., prop. 33. See also *Potts's Euclid*, prop. i., page 293; and *Simpson's Geometry*, prop. i., p. 186. Notwithstanding the apparently close connection of the two cases, Mr. Burrow appears to have been the *first* to infer the extension of the proposition alluded to in the introductory observations.

Art. VII. A method of finding the latitude at sea from having two altitudes of the sun or a star, and the intermediate time. By Mr. Reuben Burrow.

*** At the close of this paper, the author announces that, "in some future number will be given a method of find-

* It is much to be regretted that, since the discontinuance of *Leybourn's Repository*, no efforts whatever have been made to establish a journal which should have for one of its chief objects the *re-publication* of the many excellent and valuable mathematical papers which at present lie scattered over the different volumes of the transactions of various societies, in the magazines, and in the many *now* almost forgotten periodicals which have been published in England during the last hundred years. Archæological, historical, ecclesiastical, medical, chemical, and other publishing societies exist, and appear to obtain sufficient support:—these societies reprint and issue annually many scarce and valuable works in their different departments, thereby diffusing abundant information amongst their members which would otherwise, in many instances, be sought in vain. What, then, prevents the establishment of a mathematical publishing society, which shall have for its principal object the collection and re-publication of papers on mathematical subjects? It may be objected, as the Rev. T. P. Kirkman well observes, in a late number of the *Manchester Courier*, "that there are no readers, no purchasing public, to secure an author, whatever be his fame, or a publisher, whatever be his influence, from *ruinous loss*, in bringing out such books as are not intended for schoolboys or undergraduates;" and hence the impracticability of such a project might be easily inferred. Notwithstanding the *literal* truth of many of these remarks, as applied to mathematical treatises in general, the proposal appears to be worth the consideration of those who have sufficient leisure and opportunities to give it a trial; and though difficulties of a peculiar character will undoubtedly present themselves, it is to be hoped they will not be found of such a nature as to prevent the carrying out of so desirable an undertaking.

ing the latitude from *three* altitudes and *two* intervals of time, by means of the tangents, with other useful problems; also several new theorems very useful and necessary in constructing *spherical* problems, together with the doctrine of spherical loci, a subject not hitherto considered." The method of finding the latitude here alluded to was given by the proposer in the 63rd question of this *Diary*, to which reference may be made; but it does not appear that he ever published anything relating to spherics. Perhaps his removal to India would derange most of his plans, and render it impossible for him to carry out many of his intended researches; we may however suppose, with considerable probability in our favour, that the announcement here made would have its effect in inducing Messrs. Howard and Lowry to turn their attention to the subject—to the former of whom we are indebted for the best treatise on spherical geometry at that time extant; and to the latter, as Professor Davies justly remarks, "we owe every important spherical theorem that can be set down to the credit of Englishmen during at least a century past."

Art. VIII. A solution of a very difficult problem which was proposed in the *Ladies' Diary* for 1750, but never answered in any of the following *Diaries*. By Major Henry Watson.

Problem.

"To find three numbers such, that the sum and difference of every two of them shall each be a square number."

*** This question is No. 311, in the *Ladies' Diary* for 1750, where it was proposed by Mr. Landen. No solution was given to it in the next *Diary*, but by a process "too tedious to insert," Mr. Charles Bumpkin found "three numbers answering the conditions of the question." In Leybourn's Edition of the *Diaries*, vol. ii., p. 19, it is stated that a solution may be seen in *Ozanam's Dictionary*, and there is another in *Euler's Algebra*, pp. 436—9, *Hewlett's Edition*. Dr. Hutton published *three* different solutions to the question in his re-publication of the *Ladies' Diary* in 1775; one by Mr. Landen, another by Mr. Wildbore, and the third by himself. These were transferred by Mr. Leybourn into vol. ii., pp. 19—22 of his edition, to which he also added a fourth solution. An elaborate investigation is also given in vol. iv., pp. 343—351 of the same work, by Mr. James Cunliffe, of the Royal Military College, and in the same place the present article is reprinted from the *Diary* for 1776.

THOMAS WILKINSON.

Burnley, Lancashire, Aug. 30, 1849.

(*To be continued.*)

ON THE MASTING OF SHIPS.

There is nothing connected with our ships so little understood as the principle upon which to place the masts; consequently their positions, and thereby those (horizontally) of the centre of effort of the sails, are very irregular; and yet there can be but little hope of satisfactory results, at least uniformly so, until this principle be determined; for if the correct place be not "*hit*" (it is only a chance shot), the properties of the ship will be materially injured, and the constant changing, which a desire to place them correctly will entail, must be attended with considerable expense.

I am aware that men will be found who will say that they can place the masts in the exact position they ought to occupy, but it is evident that such statements are not to be relied on, for since there is little or nothing known about resistances, there can be no data for calculations.

No work mentions this subject in a satisfactory way, therefore it should be discussed.

Chapman is evidently wrong in his theory; the assumption upon which it is founded could only be true under one condition out of every variety of speed, form, &c.

The position of the centre of effort of the sail (vertically) depending in the navy rather upon the moment of stability, and upon the convenience arising from classifying masts and yards than upon the form, we should look to the necessity of adapting the form to this point, rather than lose the advantage of a large area of sail which it affords; that is, so to form the ship, as that she will require the centre of effort of sail equally high with that which this classification would give it.

The finest bow below, commencing to rise far aft, requires the highest point of sail; the short and fullest bow below, the lowest point of sail.

For the better understanding the question, it is necessary to premise that when a ship is under sail there are two forces acting on it; the one, the force of the wind on the sails; the other, the resistance of the water opposed to her motion. These forces, immediately the ship has acquired the velocity due to the strength of the wind, are equal; and, as is the case with all forces, may each be reasoned of, as if acting on only one point of the surface over which their effect is diffused. This point is that in which, if the whole force were concentrated, its effects would be the same as if it were dispersed over the whole area; it is usual to call these resultants of forces, and the points on which they are supposed to act, centres of effort.

The resultant of the force of the wind on the sails, and the resultant of the force of the water on the hull are equal, the one acting on the weather-side of the ship, in the direction into which the force of the wind resolves itself, and the other, opposed to it, acting on the leeside, in the direction into which the force of the water resolves itself, and their effect is necessarily in proportion to their relative distance from the centre of gravity. If they are equally distant they will destroy each other, and the ship will remain at rest with respect to the line of her course; if the resultant of the water pass before that of the wind, she will come up in the wind; and if the contrary, she will fall off from the wind.

If either of these cases occur, the effects must be equalised by the action of the rudder; but as its action retards her speed, its use, thus unnecessarily, should be avoided, by making a better disposition of the sail, or by altering the position of the resultant of the water by change of trim or otherwise.

In order to find the distance of the centre of effort of the wind on the sails, before the centre of gravity of the ship, the moment of each sail is determined by multiplying its area by the horizontal distance of its centre of gravity from that of the ship; the sum of the negative moments on those abaft the centre of gravity of the ship, is then subtracted from the sum of the positive moments, or those before the same centre, and the remainder will be the required distance.

I assume throughout this argument that the sails are plane surfaces: that they are not so, is evident, but as their departure from this is uniform on either side of the centre of gravity, the conclusions will be the same as though they were what I have assumed them to be;—but it must not be forgotten that it is desirable that they should be so as nearly as possible, and that in proportion as they are not, the vessel will have an injurious tendency to carry weather-helm, the centre of effort of the sail being carried to leeward of the centre line of the ship by their sagging to leeward; nor is this the only disadvantage, since they press the ship also more than when well set.

Did we know the position of the centre of effort of the resistance of the water, we should have but little difficulty in placing the centre of effort of the wind, at least, in the horizontal plane: this can be determined only by experiments; so we may examine into the different modifications of form which influence its position, endeavour to ascertain the approximate amounts, and the direction in which they require that the centre of effort of sail should be moved,—with a view not only to make that necessary adjustment, but also to tabulate the results as likely to throw considerable light upon the law of resistances. I say "approximate," as it can only be so, till more is known relative to the law of resistances of ships of various forms, &c. The modifications of form which affect the position of the centre of effect of resistance are—

1. Difference of draught.
2. Midship sections.
3. Form of bow.
4. Form of afterbody.
5. Small longitudinal stability.
6. Small lateral stability.
7. Comparative area of vertical longitudinal area.

Difference of Draught.—It is too general to choose the positions of ships' masts from those of others, each estimated on the load water-line, as if this dimension only influenced the position of the centre of effort of the water, while it seldom occurs that any two ships are sailed either in the same trim or at the same draught, though a difference on either of these points will affect the position of the centre of effort of resistance.

Let us take the case of the *Southampton* and *President* ships, differing only by two or three inches, to illustrate.

The *Southampton* was sailed 5 inches by the head. Suppose her sailed on an even keel, and suppose the *President* sailed 4 feet by the stern, that is less than usual, and their draughts about as follows:—

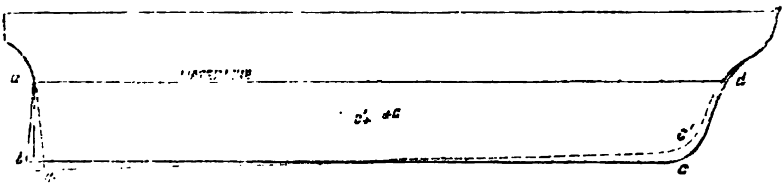
Southampton.

Forward, 19 feet. Aft, 19 feet.

President.

Forward, 17 feet. Aft, 21 feet.

The force of the wind may be resolved into two forces, one tending to drive the ship ahead, and the other to drive her to leeward, and the resistance will be made up of two forces, viz., that offered to going ahead, arising *principally* from the area of the transverse vertical plane, which would be about equal in the two ships, and that offered against going to leeward. The centre of effort at which this force would act would depend upon the position of the centre of the plane, $abcd$ and $ab'c'd$, in the two ships respectively, and as the first force in the two vessels would be equal, the position of the common centre of effort of the two forces would mainly depend upon the position of the centres, c and c'. Now the *President*, owing to the difference of draught, would have c' fully 9 feet further aft than c in the *Southampton;* therefore, if the masts are similarly situated as respects the water-line, the *President's* will be too forward by 9 feet, and, of course, I suppose the masts of each to have the same rake.



President . . . . $c - abc'd$.
Southampton . . . . . . $c' - abcd$.

Nor is this the only quantity they are too far forward; for, as the *Southampton* can only be brought to this trim by moving forward a large weight, so her centre of gravity will be moved forward also a considerable quantity, the effect of which will be to increase the negative and decrease the positive moments of the sails, for which allowance must be made in the position of the masts;—that is, the *Southampton* would require to have her masts a still farther quantity forward of that in the *President.*

Suppose another case,—that of two vessels of the same total displacement, and their greatest vertical longitudinal plane equal and similar, from which the centres of these planes would be similarly situated, and therefore the centre of effort of the water, as depending on them, would be also similarly situated.

Suppose them to differ in the form of their bows, the one having a fine bow, the other, a full one—" B. I." contends that the vessel with the fine bow would require to have the centre of effort of sail further forward. Let us then examine into the validity or otherwise of his assumption.

Suppose 20 tons of displacement taken from a main distance of 10 feet before the centre of gravity, and placed 80 feet before it—this extra displacement forward is what constitutes the difference in the two bows; the effect of this altered disposition of the displacement will be, that the full-bowed vessel will have her centre of gravity 2 feet further forward than that of the fine-bowed (that is, if we suppose the total displacement of each to be 1800 tons); as this will increase the negative moments of sail, and decrease the positive, the centre of effort will require to be moved 2 feet further forward, and of course the masts to admit of it. " B. I." may answer, that the form of the fine bow will carry the resultant forward a corresponding quantity with that which has been shown to arise from moving the centre of gravity in the full bow; this I deny, but propose to discuss it under the head of the effects of form of bow.

Again: for the same reason that the centre of gravity has been carried forward in the full-bowed vessel, will the moments of inertia of the fore body be greatly increased, and by that the pitching motions; but this will increase the mean immersion forward, carry forward

the resultant of resistances, and occasion a necessity for moving forward the centre of effort of the sail correspondently.

F——.

(*To be continued.*)

ON ABSOLUTE AND RELATIVE ZEROS.

Sir,—When Professor Young asserted, in his letter contained in No. 1345 of this Magazine, that "*isolated* zero is not only *valueless* but *sign-less*," he then, in my opinion, took up a position from which he will not easily be dislodged.

It is not, however, to defend the Professor's position that I venture to trouble you with this note; but to point out what I consider to be a "fatal slip" in the demonstration that

$$+0=-0,$$

even in the case of *absolute zero*, attempted by your correspondent, "N. Y. R.," in the last Number of this Journal.

Presuming "N. Y. R.'s" equation,

$$1-1=-1+1;$$

it is quite correct to say that

$$-1+1=(1-1)\times -1;$$

but it seems *not so* to affirm that *therefore*

$$1-1=(1-1)\times -1;$$

for this is obviously the same as

$$(1-1)\times +1=(1-1)\times -1;$$

and hence the *zeros* which, *before* the multiplication by -1, were *absolute* ones, by that process are converted into *relative* zeros, which are to each other in the ratio of

$$+1:-1;$$

since obviously

$$0\times +1=0\times -1,$$

or

$$0:0::+1:-1.$$

This "slip" appears to me to vitiate the whole of "N. Y. R.'s" remarks respecting *absolute* zeros, and hence their inapplicability to the subject in question.

In conclusion; it may be remarked that if in any case we wish to convert *absolute* zeros into *relative* ones, we have only to multiply both sides of the equation,

$$0=0,$$

by the terms of the ratio required, for then

$$m.0=n.0;$$

or

$$0:0::m:n;$$

which evidently gives the preceding case, when

$$m=+1, \text{ and } n=-1.$$

I am, Sir, yours, &c.,

ZERO.

Burnley, September 8, 1849.

BAIN AND MORSE'S TELEGRAPHS.

Decision of (the American) Judge CRANCH, in the case of ALEXANDER BAIN, Appellant, *versus* SAMUEL T. B. MORSE, Appellee.

(From the *Daily Union*, April 5, 1849.)

Upon the question of interfering applications for a patent:

The Commissioner, upon hearing, decided that Mr. Bain's claim interfered with Mr. Morse's, and that Mr. Morse was the first inventor; and rejected the claim of Mr. Bain. From this decision Mr. Bain has appealed.

It is contended by the counsel for Mr. Morse, that the judge upon appeal has no jurisdiction of the question of interference, that an appeal is given only upon the question of *priority of invention;* and that upon the question of interference the decision of the Commissioner is conclusive.

Whether it be thus conclusive, then, is the first question to be decided.

By the Act of 1836, ch. 357, sec. 7, it is enacted, that "if the specification and claim shall not have been so modified as, *in the opinion of the Commissioner*, shall entitle the applicant to a patent, he may, on an appeal, and upon request in writing, have the decision of a board of examiners, to be composed of three, &c.; and on examination and consideration of the matter by such board, it shall be in their power, or of a majority of them, to reverse the decision of the Commissioner, either in whole or in part; and their opinion being certified to the Commissioner, he shall be governed thereby in the further proceedings to be had on such application."

The section is applicable to cases where there is no conflicting applicant, and shows that the legislature, by saying, "*if in the opinion of the Commissioner*," &c., did not intend to make that opinion conclusive. On the contrary, it provides "that the board shall be furnished with a certificate, in writing, of the opinion and decision of the Commissioner, stating the particular grounds of his objection, and the part or parts of the invention which he considers as not entitled to be patented; and that the said board shall give reasonable notice to the applicant, as well as to the Commissioner, of the time and place of their meet-

ing," &c. All these provisions were evidently intended to enable the board of examiners to revise the opinion and decision of the Commissioner, and show that his opinion was not to be conclusive.

By the 8th section of the same Act, (1836), it is enacted, "That wherever an application shall be made for a patent which, *in the opinion of the Commissioner*, would interfere with any other patent for which an application may be pending, or with any unexpired patent which shall have been granted, it shall be the duty of the Commissioner to give notice *thereof* to such applicants, or patentees, as the case may be; and if either shall be dissatisfied with the decision of the Commissioner on the question of *priority* or right of invention on a hearing thereof, he may appeal from such decision, on the like terms and conditions as are provided in the preceding section of this Act; and the like proceeding shall be had, to determine which, or whether either, of the applicants is entitled to receive a patent as prayed for.

The question of priority of right of invention necessarily implies *interference*. The Commissioner, before he could decide the question of priority, must have decided that of interference; for without interference there can be no question of priority. Before I can have jurisdiction of the question of priority, I must be satisfied that there is an interference; and I must decide the question of jurisdiction as well as any other question which arises in the cause.

The opinion of the Commissioner, (mentioned in the 8th section), that interference exists, only justifies him in *giving notice thereof* to the other applicant, and appointing a day to hear the parties upon that question. He decides it only *pro hoc vice*, and for that purpose only. Upon that hearing he is to decide; and from that decision, if either shall be dissatisfied with it, on the question of priority, including that of interference, he may appeal; and upon such appeal, as I understand the law, the judge, in case of real interference, may "determine which, or whether either, of the applicants is entitled to receive a patent as prayed for." The scope thus given to the judge is broad enough to include the question of interference as well as that of priority, if it should arise.

By the Act of 1836, ch. 88, sec. 11, it is enacted, "That in all cases where an appeal is now allowed by law from the decision of the Commissioner of Patents, to a board of examiners provided for in the 7th section of the Act to which this is additional, the party, instead thereof, shall have a right to appeal to the Chief Justice of the District Court of the United States for the District of Columbia, by giving notice thereof to the Commissioner, and filing in the Patent-office, within such time as the Commissioner shall appoint, his reasons of appeal specifically set forth in writing; and also paying into the Patent-office, to the credit of the Patent Fund, the sum of twenty-five dollars.

"And it shall be the duty of the said Chief Justice, on petition, to hear and determine all such appeals, and to revise such decisions, in a summary way, on the evidence adduced before such a Commissioner, at such early and convenient time as he may appoint, first notifying the Commissioner of the time and place of hearing, whose duty it shall be to give notice thereof to all parties who appear to be interested therein, in such manner as the said judge shall prescribe.

"The Commissioner shall also lay before the said judge all the original papers and evidence in the case, together *with the grounds of his decision*, fully set forth in writing, *touching all the points involved by the reasons of appeal*, to which the revision shall be confined."

One of the reasons of appeal in this case is, that there is no real or substantial interference between the two applications.

The question of interference, therefore, is involved by the reasons of appeal, and must be decided by the judge. By limiting the jurisdiction of the judge to the points involved by the reasons of appeal, the legislature has affirmed it to that extent.

The interference mentioned in the 8th section of the Act of 1836, must be an interference in respect to patentable matters; and the claims of the applicants must be limited to the matters specifically set forth as their respective inventions; and what is not thus claimed, may, for the purpose of this preliminary inquiry, be considered as disclaimed.

The question then is, does Mr. Bain claim a patent for any matter now patentable for which Mr. Morse claims a patent?

To answer this question, it is necessary to ascertain for what patentable matter Mr. Morse now claims a patent.

In his specification, filed January 20, 1848, he says: "What I claim, as my own invention and improvement, is the use of a single circuit of conductors *for* the marking of my telegraphic signs already patented, for numerals, letters, words, and sentences, by means of the decomposing, coloring, or bleaching effects of electricity, acting upon any known salts that leave a mark as the result of the said decomposition, upon paper, cloth, metal, or other convenient and known markable material. I also claim the invention of the machinery as herein described,

for the purpose of applying the decomposing, coloring, or bleaching effects of electricity acting upon known salts, as herein before described."

The Commissioner, in his written decision in this case, says: "Such use of a single circuit [*i. e.*, to produce marks upon chemically-prepared paper] is not the point at issue; *nor is this claimed by either party*. Said Morse claims using a single circuit of conductors for a certain purpose, or in a certain way, viz., to mark his telegraphic signs; and also claims the machinery by which he accomplishes this purpose. Said Bain does not specially mention in his claim using a single circuit, though this must be considered an essential part of his invention and claim, and is necessarily involved in the final clause of his claim, to wit: 'So that in either case these form the *received communication*, substantially in the manner and with the effects described and shown.'"

The Commissioner proceeds:—The third clause of the claim of said Bain, with which the true claims of said Morse interfere, is as follows, to wit:

"Third, The application of any suitable chemically-prepared paper, without regard to the chemical ingredients used for such a purpose, to receive and record signs forming such communications — such signs being made by the pulsations of an electric current or currents, transmitted from a distant station, said currents operating directly, and without the intervention of any secondary current or mechanical contrivance, through a suitable metal marking style, that is in continuous contact with the receiving paper, thereby making marks thereon; which marks correspond with the groups of perforations in the paper *composing* the transmitted communication; or may be given by the pulsations from the spring 45 and block 46; so that in either case these form the received communication substantially in the manner and with the effects described and shown, including any merely practical variations, analogous and equivalent in the means employed, and the effects produced thereby."

The Commissioner, in his written decision, says:

"The invention, it will be seen by reference to the specifications of the parties respectively, does not consist in the use of the electric current to make marks upon chemically-prepared paper; nor making marks through a single line of conductors; nor could a claim to either of these devices have been entertained as patentable, as they have been long known."

Again: It is said by the counsel of Mr. Morse, "It is admitted that neither could patent the *battery*, the *circuit*, the prepared paper, or the marking by the electro-chemical process—it was only a *new combination* of the several parts so as to produce a new result, *or an old result in a better manner*, that either could patent."

Again: The Commissioner, in his "*reasons of decision*," says: "It is true, as Mr. Bain asserts, that no one can monopolize the use of air, fire, or water; but it is equally true that any one can monopolize the use of air, fire, or water, upon certain principles of operation which he may have invented or discovered; and this is precisely what the respective claimants, in this case, demanded as their rights, and gave rise to the interference, viz., each claimed the right to use, and exclude others from using, galvanic power to mark certain signs [which signs have been already patented by said Morse] upon chemically-prepared paper through a single circuit of conductors.

"*A single circuit of conductors*, consisting either wholly of wire, or in part of wire and part of earth, for telegraphic purposes, *were not new*; the *signs or signals* to be marked *were not new*, the same having been before patented by said Morse, and *chemically-prepared paper*, for receiving telegraphic signs by galvanism, *was not new*, the same having been patented in England, in 1838, by Mr. E. Davy. Moreover, the *use of a single telegraphic circuit*, for making the aforesaid signs upon paper, *was not new*, the same having been before patented by said Morse.

"Neither party claimed any one or any two of the above elemental features. *The invention of each was made up of the three combined;* and the advantages claimed to have been discovered by each in these combined operations were identical."

If, then, these matters are not now patentable in themselves, there is nothing patentable in Mr. Morse's claim left to be interfered with, except his claim of a patent for his invention of the machinery described in his specification, or for his combination of machinery and materials, as described therein. The claim of each applicant, therefore, is reduced to the claim *for the combination of machinery and materials* which he has invented, and does not include any of the matters claimed in his specification which are not now patentable.

These combinations seem to me to be far from identical. Mr. Bain includes in his combination the use of the perforated paper, for *composing* the communication; and of the style which passes the electric current through the perforated paper; and the machinery for transmitting the same communication to several different places at the

same time. It is said that the style is not new; but he makes it an ingredient in his combination, and in that respect his combination differs from that of Mr. Morse, and it is a very important item in connection with the perforated paper. He includes in his combination new patentable matter with old matter, not patentable, and thereby makes a new patentable combination. This new matter, thus introduced into the new combination, is admitted to be patentable in itself without combination with the old unpatentable matter; and, indeed, it seems to be a great improvement in the transmission of telegraphic information.

But it is said that Mr. Bain is only authorised to obtain a separate patent for each of those inventions, and cannot claim a patent for his new combination of the old and new together. If, however, his new combination of old materials be patentable, (which must be admitted, or it would not interfere with Mr. Morse's claim,) it seems to be not the less patentable because it includes the new matter in connection with the old. The old matter may not, in itself, be patentable, but joined to the new matter, a combination may be formed which may be patented. He is not obliged to take separate patents for each new patentable matter. He does not now ask for them; he may be willing to ask only for a limited use of those new matters—*to wit, in combination;* and not for an exclusive use of them for every purpose to which they may be applicable.

Mr. Godson (in p. 63) says, "A combination or arrangement of old materials, when, in consequence thereof, a new effect is produced, may be the subject of a patent. This effect may consist either in the production of a new article, or in making an old one in a better manner, or at a cheaper rate."—"This manufacture may be made of different substances mingled together, or of different machines formed into one, or of the arrangement of many old combinations." "Each distinct part of the manufacture may have been in common use, and every principle upon which it is founded may have been long known, and yet the manufacture may be the proper subject for a patent. It is not for those parts and principles, but for the new and useful compound, or thing thus produced by combination, that the grant is made; it is for combining and using things before known, with something then invented, so as to produce an effect which was never before attained."

The counsel of Mr. Morse, in argument, said:—

"It is obvious, and is admitted by our adversaries, that Morse's instrument is a very different thing, in its *form* and *structure*, from Bain's."—But *form* and *structure* are very important matters in machinery; and if they enable the operator to do the work in a better manner, or with more ease, or less expense, or in less time, it is no interference; but is an improvement for which the inventor may have a patent.

When the application is for a patent for a combination of machinery and materials, form and structure become *substance;* they are of the essence of the invention; and an admission that Morse's instrument is a very different thing, in its form and structure, from Bain's, is an admission of a fact which is *primâ facie* evidence, at least, that there is no interference between the two, and throws the burden of proof on the other side.

There was no evidence laid before the Commissioners of Patents upon the question of interference, so that he must have adjudged the interference upon a comparison of the two specifications; possibly without considering that the only patent which either could obtain would be a patent for his own combination—all the materials of which Mr. Morse's combination consists being old, and not now patentable.

The question is not now whether the claims of Mr. Bain and Mr. Morse interfere as to matters not now patentable, but whether they interfere as to matters *now patentable*; and the only matter now patentable in Mr. Morse's specification is his own combination of machinery and materials. That combination constitutes his machine; and his machine is admitted to be a very different thing, in its form and structure, from Mr. Bain's. Form and structure constitute the identity of machinery. The combination consists in *form* and *structure;* and the patent, if issued, will, I presume, be issued for the *form* and *structure* of the instrument.

It being admitted that the form and structure of Mr. Bain's instrument is very different from Morse's, there can be no interference in that respect, and if form and structure constitute the identity of machinery there is no interference in the two instruments: and if the instruments are the combinations, or the result of the combinations, for which patents are now claimed, there is no interference in the two instruments in regard to any matter now patentable.

But it is not necessary to rely alone upon the admission of Mr. Morse's counsel, to show that there is a great difference between the machinery used by the contending applicants to effect the object: *i. e.*, the rapid transmission of intelligence by the power of the electric current. Any one who will compare the two specifications, and drawings,

and models, will at once perceive the difference.

A patentable improvement is not an interference.

The Commissioner, in his written decision, says, "It appears from the records of the office, that the application by said Alexander Bain, subject of Great Britain, was made April 18, 1848; and upon examination of his claims, it was found that the before-mentioned claim could be *admitted to patent*, no invention of a like character appearing in the public records of the office, nor in any printed publication. Prior, however, to the final issue of the case, the secret archives were consulted; and it was found that an application, filed by Samuel F. B. Morse, January 20, 1848, had been there deposited, in compliance with provisions of law, which presented claims conflicting with those, before mentioned, set up by said Bain."

This shows that but for the supposed interfering claim of Mr. Morse, Mr. Bain was entitled to his patent; and if there be no interference in respect to patentable matter, he is still entitled to a patent for his own combination.

But the counsel for Mr. Morse, say: "There is an interference—that Bain's third claim palpably covers the whole of Morse's first claim; and, if granted, Bain could do all that Morse claims an exclusive right to do; he could write Morse's characters precisely as Morse does; and that herein consists the interference."

But the only matter now patentable, and claimed in Mr. Morse's specification, is *his peculiar combination of material and machinery, as therein described.* All the materials used in that combination are old; and he will not, under this patent, be entitled to the exclusive use of any of them separately, or in any other combination than that which he has described in his specification. There cannot be a patent for a *principle;* nor for the application of a principle; nor for an effect. Two persons may use the same principle, and produce the same effect *by different means*, without interference or infringement, and each would be entitled to a patent for his own invention.—*Godson*, 63, 68, 74.

So, in the present case, although the power used by both applicants is the same, and the subject the same, yet, as the effect is produced by means which appear to me so different as to prevent an interference, *the question of priority of invention does not arise.* It is, therefore, not a case under the 8th section of the Act of 1836, but under the 7th section of the same Act. So that each of the applicants may have a patent for the combination which he has invented, and claimed and described in his specification—provided he shall have complied with all the requisites of the law to entitle him to a patent.

If this were a doubtful question, I should think it my duty to render the same judgment, so as to give Mr. Bain the same right to have the validity of his patent tested by the ordinary tribunals of the country, which Mr. Morse would enjoy as to his patent; and finally, to obtain the judgment of the Supreme Court of the United States upon it. For if the Commissioner and the Judge should reject Mr. Bain's application for a patent, the decision would be final and conclusive against him, unless he could obtain relief by a bill in equity under the 16th section of the Act of 1836, and the 10th section of the Act of 1829; which, it is said, is doubtful.

I am, therefore, of opinion, and so decide—

That there is no interference in the claims of these applicants, in relation to any matter (contained in their respective specifications) *now patentable;* and therefore that Samuel F. B. Morse is entitled to a patent for the combination which he has invented, claimed, and described in his specification, drawings, and model. And that Alexander Bain is entitled to a patent for the combination which he has invented, claimed, and described in his specification, drawings, and model; provided they shall, respectively, have complied with all the requisites of the law, to entitle them to their respective patents.

I deem it unnecessary, therefore, to decide upon any other points involved by the reasons of appeal.

W. Cranch.

STEAM NAVIGATION IN INDIA—SIR SAMUEL BENTHAM'S VERMICULAR BARGES.

Sir,—My attention has been drawn by a friend to your last week's Number, in which you give a drawing of the late Sir Samuel Bentham's vermicular barges, and a short article thereon, concluding with the following paragraph:—

"For it may be presumed that the Imperial Vermicular and the Amphibious Carriages of Sir Samuel have suggested the idea of putting these inventions to extensive use in the shallow and tortuous rivers of India."

I am sure you will do Mr. Bourne the justice to believe, that had Sir Samuel's invention suggested the steam train for Indian rivers, he, Mr. B., would have fairly and openly acknowledged the source from which

he had derived it. I can bear testimony to the fact, that until the article on Indian River Navigation appeared in the *Illustrated London News*, of the 1st. inst., Mr. Bourne had not the slightest conception of so similar, I may say, identical an invention having been originated by another. Indeed, until two months' ago, or a less period, Mr. Bourne was unaware of any steamer on the Continent having been constructed with mechanism to overcome shoals; and it has afforded him no slight amount of satisfaction to receive from engineers on the Continent information respecting vessels which now perform regular journeys, and creep off shoals, and over the river bed in shoal water, without any difficulty; thus entirely confirming his statement contained in his published Report.

To the late Sir Samuel Bentham appertains the merit due to the first originating of this invention, and especially for the Russian rivers; but to Mr. Bourne belongs the credit of originating at a later date, with the additional application of steam power and a more complete machinery for creeping off and over shoals, the same invention, entirely independent, and more particularly designed for the rivers of India—another instance of the same invention having been brought forward by a different party, without the slightest knowledge of the other's discoveries.

Your Magazine has been most satisfactorily the register of a valuable invention, and by it we are enabled to claim justice for the late honourable inventor; these articles, moreover, afford most valuable details, as the result of experiments on a large scale, and prove its entire practicability.

I remain, Sir, your obedient servant,

Geo. B. W. Jackson,
Civil Engineer.

3, Winchester-house, Old Broad-street,
September 11, 1849.

ON THE EXPANSIVE ACTION OF STEAM, AND A NEW CONSTRUCTION OF EXPANSION-VALVES FOR CONDENSING STEAM-ENGINES. BY W. FAIRBAIRN, ESQ., C.E., MANCHESTER.

[From a Paper read before the Institution of the Mechanical Engineers, Birmingham, July 25, 1849.]

The innumerable attempts that have been made to improve the principle of the condensing steam-engine since the days of its celebrated inventor, Watt, have almost all of them proved failures, and have added little, if anything, to the claims, next to perfection, of that great man's ideas. It would be idle to speculate upon the various forms and constructions from that time to the present, which have been brought forward in aid of the original discovery of condensation in a separate vessel. All that has been done is neither more nor less than a confirmation of the sound views and enlarged conceptions of the talented author of a machine which has effected more revolutions and greater changes in the social system than probably all the victories and all the conquests that have been achieved since the first dawn of science upon civilised life.

It would be endless to trace the history of the successful and the unsuccessful attempts at improvement which for the last half century have presented themselves for public approval; suffice it to observe, that no improvement has been made upon the simple principle of the steam-engine as left by Watt, and but few upon its mechanism. Among the latter may be enumerated the improvements in the construction and mode of working the valves; and of these the D valve, by the late Mr. Murdoch, and the use of tappets as applied to the conical valves, appear the most prominent and the most deserving of attention.

In the construction of the parallel motion, the application of the crank, the governor, and the sun and planet motions, all of which have risen spontaneously from the mind of Watt, there is no improvement. The principles upon which all of them are founded have been repeatedly verified beyond the possibility of doubt, and their mechanism is at once so exceedingly simple and so ingeniously contrived as to limit every attempt at improvement in those parts of the steam-engine. What appears to be the most extraordinary part of Mr. Watt's engine is its perfect simplicity, and the little he has left to be accomplished by his successors.

It will be in the recollection of most persons conversant with the steam-engine, that the hand gear for working the valves by the air-pump or plug-rod, gave a self-acting and continuous motion to the machine; and the facility which these means afforded for moving the engine in any direction and at any required velocity, gave it a degree of docility and power beyond the expectation of its most sanguine admirers.

For a considerable length of time the hand gear was the best and most effective mode of applying the motion of the steam-engine to the valves; subsequently the oscillating and revolving tappets, fixed upon a shaft and driven by wheels or an eccentric, came into use, and by means of vertical rods communicated motion to the valves, and thus a similar effect was produced as by the hand gear; next came Mr. Murdoch's D valve and eccentric motion, which for

simplicity has never yet been equalled. The D valve and the flat-plate valve are nearly synonymous, with this difference only, that the D valve presses with less force upon the face, and consequently works easier than the flat valve, which in every case is exposed to the full pressure of steam. It is true that means have been adopted to obviate this objection in large engines, by a preparation on the back of the valve, which is made steam-tight, and by a communication with the condenser, a vacuum is formed over a proportionate area of surface, sufficient to equalise the pressure and admit an easy motion of the valve.

The expansive principle upon which steam-engines are now worked, and the economy which this system has introduced in the expenditure of fuel, has effected considerable changes in the working of the valves, and has rendered the D and plate-valves almost inadmissable for such a purpose. To the skill, ingenuity, and careful attention of the Cornish engineers, we are indebted for many of the improvements connected with the use and application of expansive steam; and taking into account the high price of coals, and the urgent necessity of economy in those districts, which combined with a system of registry and encouragement held out by premiums, as described by Mr. John Taylor, we may reasonably conclude that other parts of the kingdom have been greatly benefited by the excellent examples set before them by the Cornish miners and engineers.

For a great number of years, and up to a recent period, the economy of steam and the working of the steam engine expansively, were but imperfectly understood in the manufacturing districts; and although the Cornish miner set an excellent example and exhibited a saving of more than one-half the fuel, there were, nevertheless, few if any attempts made to reduce what is now considered an extravagant expenditure in most, if not the whole, of our manufactories. But in fact the subject was never brought fairly home to the mill-owners and steam navigation companies, until an equalization or reduction of profits directed attention to the saving attainable by a different system of operation.

Ten years ago the average or mean expenditure of coal per indicated horse power was computed at from 8 to 10 lbs. per horse power per hour, but now it is under 5 lbs. per horse power per hour in engines that are worked expansively, and even then they are far below the duty of a well-regulated Cornish engine, which averages from 2½ to 5 lbs. per horse power per hour.

This difference in the consumption of coal may be attributed to two causes; first, the conditions under which the duty of the two engines (that of the Cornish miner and the manufacturer) are respectively performed. The first being chiefly employed in pumping water, has the benefit of alternate action in overcoming the inertia of a large mass of matter, which when once in motion is easier continued, for a definite time, than a continuous power of resistance, such as exhibited in corn and cotton mills. Another cause is the greater care and attention which the Cornish man pays to his boilers, steam pipes, &c.; they are never left exposed, but are carefully wrapped up in warm jackets and well clothed, to prevent the escape of heat. Even at the present day, it is lamentable to see (in the coal and iron districts) the great and extravagant waste that is continually going on, for want of a little considerate attention in this respect; the only excuse is the cheapness of the fuel—but that is not an excuse, for if one-half can be saved, and coal could be got at 1s. per ton, it is certainly desirable to save sixpence out of the shilling when that can be accomplished at a trifling expense. But one of the chief, if not one of the most important reasons for the exercise of economy in fuel, is the reduction of profits on articles manufactured by power; under these circumstances, a saving in coal becomes a consideration of some importance, and to these reductions alone may be traced the powerful stimulus which of late years has been prevalent in that direction. The low rate of profit in manufacturing operations, and a desire to economise and reduce the cost of production to a minimum, has been of great value in its tendency to improvement in the economy and efficient use of fuel, and also to the use of high-pressure steam and its expansive action when applied to the steam engine. In France and most other parts of the continent this system has been long in use, and although its effects as well as its economy have been long known in this country, it was only within the last few years that the benefits arising from it were appreciated. For a great number of years a strong prejudice existed against the use of high-pressure steam, and it required more than ordinary care in effecting the changes which have been introduced: it had to be done cautiously, almost insidiously, before it could be introduced. The author of this paper believes he was amongst the first in the manufacturing districts who pointed out the advantages of high-pressure steam, when worked expansively,* and for

* See Paper read before the Geological Society of Manchester in the year 1840, on the Economy of Fuel.

many years he had to contend with the fears and the prejudices of the manufacturers, before the present system of economical working was adopted.

The first attempt was by improvement in the construction of boilers,* and subsequently in the valves of the steam engine, adapted to either low or high-pressure steam when worked expansively; the latter of which it is the principal object of the present paper to develope.

The expansive action of steam has been variously estimated by different writers, but all seem to agree in opinion that a considerable saving is effected by that process. It therefore becomes a question of importance in a community whose very existence almost depends upon the steam-engine, how to work it advantageously and at the least possible cost. The great variety of schemes and forms which have been adopted for the attainment of these objects have been exceedingly various, ingenious, and interesting; and the investigation of the different theories and applications that have been submitted for public approval, would form an exceedingly attractive, if not a useful, history of the various discoveries to which we are in a great measure indebted for the present improved construction of the steam-engine.

The elastic force and expansive action of steam were well known to Mr. Watt and some of his immediate contemporaries and successors, such as Smeaton, Cartwright, Woolf, Trevithick, and others; but the fears entertained of explosion at that early period, and the difficulty of constructing vessels strong enough to contain high-pressure steam, were probably the greatest drawbacks to its introduction. Woolf and Trevithick were probably among the first to grapple with this dangerous element; and the former, in order to economise fuel, introduced the double-cylinder engine, whereby a great saving was effected by increasing the pressure of steam in the boiler, and allowing it to pass from one cylinder to another of three or four times the capacity, by which its volume was expanded; and by these means a saving was effected and an extra duty performed. If, for example, taking a double-cylinder engine, the high-pressure cylinder being one-quarter of the capacity of the cylinder from which the steam is condensed, there will be for one cylinder-full of steam an expansion of four times its volume; this, of course, with a diminished pressure in the ratio of the capacities of the two cylinders. Comparing this with a similar process in a single cylinder equal in capacity to the two cylinders, and fitted with a well-constructed apparatus, regulated so that only one-fifth of the contents of the cylinder (equal in capacity to the small cylinder on Woolf's plan) is filled with steam of equal density, and the remaining four-fifths (equal in capacity to the larger cylinder) is allowed for expansion, it is evident that the communication being thus suddenly cut off from the boiler after the piston has been urged through only one-fifth of the length of the stroke, the expansive force is then used in completing the remaining four-fifths of the stroke, and the result must be nearly the same as that obtained with the two cylinders on Woolf's plan. The advocates of Woolf's system, however, insist upon its superiority, not from the actual force given out (which is rather in favour of the single cylinder than the double, in consequence of increased condensation in the steam passage between the two cylinders), but from the superior action and greater regularity of motion which in the former case is produced. To some extent this is the case, but not to any appreciable amount, provided the fly-wheel is well proportioned to the pressure and power at which the engine is worked. In the double engines which are now in common use, that is, when two single engines are coupled together with the cranks at right angles to one another, there is less occasion for a heavy fly-wheel, as the effect of a large expansion is less felt, if not effectually neutralized. The results, therefore, of the double-cylinder engine and the single engine working at equal rates of expansion, are virtually the same as regards power and economy of fuel, if the comparison be not in favour of the single engine.

Having come to the conclusion that the same duty can be performed by the single as by the compound engine, and considering the important advantage of simplicity in mechanical construction, in opposition to complexity, however ingeniously contrived, it becomes a question how to obtain an effective as well as a simple process for the attainment of that object.

The first attempt was by revolving tappets, which had been long in use; these being formed and regulated in such a manner as to cut off the steam at such a point of the stroke as to give the exact quantity of expansion required. These tappets, to say the least, were, from various reasons, objectionable, as the weight of the vertical rods and the slowness of motion prevented them from producing the desired effect. The steam valves could, however, be fixed so as to cut off the steam at the required point of the piston passage in the cylinder; but the

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* See Report on the Prevention of Smoke and Economy of Fuel.—Transactions of the British Association, 1844.

motion is not effected with the velocity essential to an efficient process of expansive action. Other processes have been tried for working steam-engines expansively, besides those already noticed; amongst them may be noticed the equilibrium valve, worked by double cams from the crank shaft. This method is generally used and adapted to the marine and old engines; but its application is seldom of much value, unless the engines and boilers are capable of bearing a pressure of 15 lbs. to 20 lbs. on the square inch.

Another fault to which this description of valves is subject is, their distance from the steam-ports into the cylinder, and the large quantity of steam which occupies the space between the cut-off valve and the working cylinder of the engine.

To remedy these defects, and to apply a better system of expansion to the common condensing engines, the following apparatus and mode of working the valves was introduced.

In giving a description of this effective and simple apparatus, it is but fair to state that the first idea of this invention was suggested by Robert Brownhill, at first imperfectly constructed, but since greatly modified and perfected by the author of the present paper.

. . . .

In the construction of a steam engine, two important considerations present themselves,—the attainment of a maximum of force, and the minimum in the consumption of fuel. To acquire the first, it is requisite to form such an arrangement of the working parts as to obtain the closest approximation to a perfect vacuum under and above the piston, and the other is accomplished by having as small an expenditure of steam as possible. These desiderata are, to a great degree, attained by the principle upon which these valves are constructed, and the way in which they are worked. Each of the steam chests contains two double-beat valves, one for the admission of the steam to the cylinder, and the other for its escape into the condenser; also the shut-off valve and the throttle valve; and these valves constitute the whole of the openings by which the steam is admitted and returned from the cylinder. All the four valves are of the same area and dimensions; but the steam valves are not lifted up so high as the exhaust valves, for the reasons which are afterwards given. The double-beat valves of this construction have certain proportionate areas, the upper portion being larger than the bottom, in the ratio of 1·158 to 1·000. The object of this enlargement of the upper part of the valve is to give a preponderance to the pressure of the steam on the top side, in order to overcome the pressure of the packing in the stuffing-box which embraces the spindle, and to assist the gravitating force of the valve in its descent when liberated from the cams.

The mode of working the valves is by shafts and wheels, which derive their motion from the crank shaft, and revolve at the same speed. A vertical spindle, upon which two circular discs, P P, are fixed, passes through the steam chests, and by its rotary motion the cams which are fixed upon these discs raise the valves as they pass under rollers, which are connected to the valve spindles by cross heads, M M. By these means the valves are raised and retained open or shut for any definite period. The rollers are steadied by the cross heads sliding upon the vertical guide-rods, at their outer ends, and sliding at their inner ends in vertical grooves in a centre boss, which is supported by the guide-arms.

To work this engine economically, much depends upon the pressure of the steam and the amount of expansion given to the valves. The usual practice is to work with steam, at 15 lbs. on the square inch, and cut off at one half the stroke, and expand the other half; but in other cases, when the engines and boilers are calculated to bear a high pressure of steam, (say from 30 to 40 lbs. on the inch,) the cams are formed so as to cut off the steam at one-third or one-fourth of the stroke. There are generally three, and sometimes four cams upon each of the discs, so as to cut off the steam at one-half, one-third, or one-fourth, or at any other point corresponding with the force of the steam and the load respectively.

To obtain this range of expansion, the rollers which work the steam valves are movable, by brass strips which slide in the grooves in the cross heads, so as to bring the rollers over any one of the cams that may be required; and there are fixed pointers which show, by a graduated scale on each brass slide, the exact point of the cylinder at which the steam is cut off, and by these means the extent of expansion is regulated, and brought under the eye of the engineer.

It has already been stated that the steam valves are not lifted so high as the exhaust valves, and the reason of this is, that as the exhaust valves are not variable in their action, and always require full openings into the condenser, it is desirable to retain them open throughout the whole length of the stroke. This process is effected with a greater degree of certainty than by any other description of valve. The exhaust valves are raised suddenly by the short inclined planes of the cams; and having

allowed time for the escape of the steam from the cylinder through a wide passage into the condenser, they suddenly fall by gravitation, and thus a more complete vacuum is formed under the piston than is probably attained by any other process.

The working of these valves is effected with a degree of certainty and simplicity which renders them very satisfactory, both as regards their efficiency in conducing to the economy of steam, and the perfect ease with which they are worked.

REPORT OF THE COMMISSIONER OF PATENTS OF THE UNITED STATES ON EXPLOSIONS OF STEAM-BOILERS, DECEMBER 30, 1848.

. . . . . .

The returns received enumerate 233 explosions of steam-boat boilers, from which accidents the number killed (as given in 164 cases) is 1805; making an average of 11 for each accident. If the 69 cases in which the number killed is not stated average the same; the total loss of life, in the 233 cases, would amount to 2563.

The number wounded, in 111 cases, is 1015—an average of 9. The same calculation as in the former case would give as the total number wounded, 2097; making the whole number of sufferers 4660.

The amount of pecuniary loss sustained in 75 cases is 997,650 dollars—giving an average loss of 13,302 dollars by each explosion; which, applied to the whole number of cases, would make the entire loss 3,099,366 dollars.

Of the explosions enumerated, 202, or ·867 per cent.; occurred on the southern and western waters; 146, or ·626 per cent., on the Mississippi river and its tributaries; 90, or ·386 per cent., on the Mississippi alone; 40, or ·172 per cent. on the Ohio. The number of explosions for each locality is given in detail, in the Appendix [E.]

From 1830 to the present time the number of explosions given is 198; making an average of 10 each year, with 110 as the average annual loss of life, and 90 the annual average of wounded; the total number of sufferers, annually, being 200; and the annual pecuniary loss 133,020 dollars.

The steam-boat tonnage of the western rivers in 1846, was 249,055; and the whole value of the commerce of these boats 82,206,719 rix-dollars. The probable extent in miles of the steam navigation of the western waters, as estimated by Colonel Long, of the topographical engineers, is 16,674.* The whole number of steam vessels built in the United States from 1830 to 1847, inclusive, is 1915.* The losses by explosion during the same period amount, according to the returns furnished, to 198, or about 10 per cent.

There is something in the appalling nature of steam-boiler explosions which strikes public attention, and has given rise to an impression that steam-boats and railroads are more dangerous modes of conveyance than any others. It is to be regretted that no direct means of making a comparison through a series of years, between the losses by ordinary navigation and those by steam navigation are in the possession of the office.

To make a comparison which should be perfectly fair, it would be necessary to take an equal number of steamers and other vessels having the same route, and exposed in common to the same sources of danger, except those arising from the employment of steam as the motive power. It would be very difficult to obtain the means of doing this. But a general and somewhat loose comparison can be made, which may serve to correct a false impression which undeniably exists with regard to the comparative safety of the two modes of travel. It appears from a statement contained in a memorial addressed to Congress on this subject, that in the year 1839 the number of American vessels lost by ordinary navigation was 1059, and that in the month of December alone of that year, 181 vessels, and 179 lives were destroyed.† Thus the number of lives lost in that month is nearly double the average annual loss of life by steam-boat explosions, as deduced from the foregoing calculations. A comparison of the number of vessels exposed would not give a fair estimate of the relative danger of the two modes of transportation, because the number of individuals exposed to the dangers from steam transportation is vastly greater in proportion to the number of vessels than those exposed in ordinary navigation.

In speaking thus favourably of the comparative safety of steam navigation, it is not intended to assert that steam has not added, in each individual case, a new element of danger to the means of transportation where it is employed. But in endeavouring to estimate the absolute risk in each kind of navigation, we must take into the account every source of danger to which each is subject, and so doing, we find the risk from ordinary navigation to exceed that from navigation by steam. In the case of the former, disasters frequently occur in a distant quarter, in the

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* American Almanac, 1849.

* Rep. Sec. Treas. Dec. 1847. Sen. Doc. No. 3, 30th Cong., 1st Sess., p. 396.

† Sen. Doc. 309, 1st session, 26th Congress.

presence of comparatively few witnesses, and many of them are never noticed by the press. They are regarded as matters of course, the results of natural causes, over which man has no control. In the latter, on the contrary, every circumstance is present which would tend to exaggerate the impression upon the public mind. It is merely for the purpose of removing an injurious misconception that the comparison just given, which does not pretend to accuracy, has been made.

For the five years ending with 1828, the ratio of explosions to the number of exposures on steam-boat routes from New York city, was 1 to 126,211. In the next five years, ending with 1833, the ratio was reduced so as to show 1 to 151,931; and in the next five years it fell to 1 to 1,985,787.*

The result of a similar calculation with reference to western navigation is less favourable. In the memorial of a "Committee on Abuses of Steam Navigation at Cincinnati," laid before Congress at its last session, the number of lives annually exposed to the dangers of steam navigation is estimated at 8,185,000. Taking the average annual loss of life on these waters at 70,† we find its ratio to the whole number of lives exposed, to be 1 to 102,642, and the ratio of explosions to the number of exposures to be 1 to 560,616.

From these facts, it appears that the dangers of steam navigation on the western waters, though obviously greater than those at the east, still bear a favourable comparison with those of other modes of water conveyance. Yet so much terror has been excited in the public mind by accidents of this kind, that the prevention of them has (and, no doubt, properly) been considered by those nations which have made most use of the powerful and useful, though dangerous agency of steam, as calling for special legislative interference. As early as 1817,‡ a Committee of the British Parliament was charged with the investigation of the causes of explosions, and much valuable information was elicited by the examination of engineers and others, which they instituted. That Committee felt and acknowledged the inexpediency of "legislative interference with the management of private concerns or property, further than the public safety should demand;" but they urged "that a consideration of what is due to public safety has on several occasions established the principle that where that safety may be endangered by ignorance, avarice, or inattention, against which individuals are unable, either from the want of knowledge or of the power, to protect themselves, it becomes the duty of Parliament to interfere." This principle, has been acknowledged also by the French Government and by our own. Of the propriety and necessity for legislation of some kind there can be no doubt; the only question is, as to what the character of that legislation ought to be. The determination of this question involves the consideration of the causes of these fatal occurrences, and the remedies which have been proposed.

The fact that the steam-engine has come into such general use, and has been placed under the management of men widely differing in their education and judgment, and many of them entirely destitute of scientific knowledge, has given rise to a great variety of hypothesis designed to account for the explosions of steam-boilers. Most of them have been mere crude speculations, without any foundation in fact or in physical analogy. Such are the pretended explanations which refer the explosion to the presence of electricity or the generation of hydrogen gas, and its union in explosive proportion with oxygen within the boiler. Of the former hypothesis, it is only necessary to say, that electricity, if present at all, would reside on the *outside* of the boiler; and of the latter, that the necessary conditions are not present which would render it probable. In the ordinary condition of a boiler, no hydrogen is produced; and if it were present, it could not procure a sufficient supply of oxygen to combine with it in explosive proportion.*

Another hypothesis accounts for the explosion in this way: the water falling below the fire line in the boiler, the portion of the latter thus exposed becomes excessively heated, and communicates its heat to the

* Redfield's Replies to British Commissioners, Sen. Doc. 309, 1st sessions, 26th Congress.
† Calculated by the per centage.
‡ British Parliamentary Reports, 1817, vol. iv.

* The production of hydrogen was referred to the decomposition of water by the heated metal. The conclusions drawn by the Franklin Institute Committee from their experiments to determine "whether any permanently elastic fluids are produced within a boiler when the metal becomes intensely heated," are, "1. That the gas obtained by injecting water upon the bottom of a boiler which was at a bright red heat, was nitrogen gas with a variable quantity of oxygen; it was, in fact, atmospheric air, deprived by the heated metal of more or less of its oxygen. 2. That this air was derived principally from the current into the boiler when surcharged steam had ceased to be formed, and the boiler was left dry; there will therefore be no such quantity in a working boiler where the air must be supplied from the cold water thrown in. 3. That water in contact with heated iron in a steam boiler, the surface being in its ordinary state, clean, not bright, *is not decomposed by heat*."—*Frank. Jour.*, vol. xvii., p. 222.

steam, which thus becomes *surcharged* with heat. Now steam, when heated separately from the water which generates it, follows the law which regulates the expansion of ordinary gases, *i. e.*, it expands $\frac{1}{480}$th part of its bulk (or nearly) for every degree of Fahrenheit above the freezing point. The increase of elastic force is, therefore, under these circumstances, very small in proportion to the increase of temperature. But while the steam is thus *surcharged*, a supply of water is sent into the boiler, the surcharged steam at once becomes converted into *saturated* steam of high elastic power, and an explosion follows. This hypothesis, although ingenious, and long received as the true explanation of the phenomenon, is found to be contradicted by the results of careful and repeated experiments. The committee of the Franklin Institute,* "appointed to examine into the causes of the explosions of the boilers used on board of steam-boats, and to devise the most effectual means of preventing the accidents, or of diminishing the extent of their injurious effects;" to whose valuable labours, which have thrown great light upon this whole subject, frequent reference will be made in this report, made a series of experiments in the prosecution of one point of their inquiries, to "ascertain whether intensely heated and unsaturated steam can, by the projection of water into it, produce highly elastic vapour," and satisfied themselves that in no case was an increase of elasticity produced by injecting water into hot and unsaturated steam, but the reverse; and, in general, that the greater quantity thus introduced, the more considerable was the diminution in the elasticity of the steam.†

A fourth hypothesis has been advanced in a communication to this office, from Mr. N. Sawyer, mechanical engineer of Baltimore, which may perhaps deserve the test of experiment. It supposes the water in a steam-boiler to be permanently thrown out of level by the unequal pressure on its surface, resulting from the escape of the steam through the throttle-valve, and at one end, and the consequent diminution of pressure at that point. This alteration of level, of course, exposes a portion of the boiler to become unduly heated, and when the working of the engine is stopped, the restoration of level by gravity brings a quantity of water in contact with the overheated metal, producing highly elastic steam, which, according to the author, may result in an explosion. The existence of the difference of level here supposed, is supported by the testimony of Mr. C. Evans, who remarks, in an article on the causes of explosion, that "wherever the steam is taken from to supply the engine, there will be the greatest ebullition, and the water will be higher there than in any other part of the boiler."* The Franklin Committee, in their experiments to ascertain "whether on relieving water heated to or above the boiling point from pressure, any commotion is produced in the fluid," found that, "on making an opening in the boiler, even when the pressure did not exceed two atmospheres, *a local foaming* commenced at the *point of escape*, followed soon by a general foaming throughout the boiler, more violent in proportion as the opening was increased.† Though the difference of level thus produced could not, it is believed, be sufficient to account for the production of a quantity of steam great enough to result in an explosion, yet the extent to which it would operate could be determined only by experiment.

A hypothesis which has been lately advanced, and to which the attention of Congress has been asked, in a published letter from its author, addressed to the Hon. John Davis, of the Senate, would not have been noticed here but for the latter circumstance This explanation of explosion, so far as it can be gathered from the pamphlet in which it is set forth,‡ attributes the phenomena to the action of liberated caloric, set free by relieving the pressure under which its combination with water is stated to be alone possible. This hypothesis seems to have been suggested by the supposed impossibility of accounting for the phenomena of explosion from the gradually-increased elasticity of steam by heat. That a gradual increase of pressure can produce all the effects of the most violent explosions, has been conclusively proved by the experiments of the committee of the Franklin Institute; in which it was shown that the very effects which, in the pamphlet alluded to, are considered impossible to arise from such a cause, did actually follow the gradually-increased tension of the steam.§ The existence of one sufficient cause, fully supported by the experiments of men so distinguished for scientific ability as were the members of that committee, renders unnecessary a resort to vague hypotheses, unfortified by facts, having no foundation in physical analogy, and, as in the present case, based upon an assumption in contradiction of a well-known physical law. Such hypotheses can only serve to divert the minds of practical men from the true causes

* Dr. A. D. Bache was the chairman of this committee.

† *Journ. Frank. Inst.* vol. xvii., p. 19.

* *Pittsburgh Morning Chronicle*, March 2, 1848.

† *Frank. Jour.*, vol. xvii., p. 8.

‡ Pamphlet on "The causes and Effects of Explosions in Steam Engines," &c., by John Wilder New York, 1847.

§ Rep. on Experiments, p. 68.

of these fatal disasters, and thus still farther to embarrass the question of their proper remedy.

The question of the causes of steam-boiler explosions, if ever solved, is to find its solution in the researches of men of true science, conducted by the order of the Government, and at its expense. The experiments necessary to its full elucidation require too heavy an outlay to be within the reach of the means of private individuals, or even institutions; and the nature of the interests to be protected have made them, by the acknowledgment of all, a proper object of public appropriation. The most valuable contributions to our knowledge of the causes of explosions have been made by the scientific labours of the committee of the Franklin Institute, undertaken at the request and prosecuted at the expense, so far as the apparatus was concerned, of the Treasury Department, in 1831. The services of the committee were gratuitous, although rendered at the expense of much time and labour, and the chairman, Dr. A. D. Bache, the present superintendent of the coast survey, devoted the greater part of his leisure during four years to the investigation. Previous to commencing the experiments, the committee addressed a circular to every engineer known to them as connected with the practical application of steam, and who had any personal knowledge of the explosion of a boiler. The answers to these circulars, though containing many crude hypotheses, furnished a valuable collection of facts and suggestions which served to guide the researches of the committee.* The undersigned cannot but believe that the institution of a new series of experiments on the same subject, conducted in the same spirit, and on the same liberal scale as those of the committee alluded to, would serve to confirm the knowledge already acquired, and throw still further light upon this interesting and important inquiry.

The causes of explosion, as laid down by the committee, are:

1. Excessive pressure within a boiler, the pressure being gradually increased.

2. The presence of unduly-heated metal within a boiler.

3. Defects in the construction of a boiler or its appendages.

4. The carelessness or ignorance of those intrusted with the management of the steam-engine.†

The causes, so far as they are stated in the returns to this office, may all be included under one or other of these classes, and they have accordingly been so classified in the summary found at the end of the Table of explosions. [Appendix C.]

How far these causes are correctly assigned, the undersigned is not able to say, as the means by which they were ascertained are not known to this office. It is desirable that in case of future explosions, provision should be made for obtaining full and accurate information of the nature and causes of the accident. Entire reliance cannot be placed on the testimony of ordinary eye-witnesses, however honest their intentions, and still less confidence can be reposed in that of the engineers and officers of the boat on which the accident occurs, as they are directly interested in showing that it was the result of no dereliction of duty on their part. But, improper influences aside, persons unacquainted with the nature and properties of steam and the steam-engine are not competent to form an opinion of any value upon the causes of an explosion. Nor are those who have a merely practical knowledge of these matters in a better situation for this purpose. They have too often preconceived opinions or hypotheses to which they are anxious to make facts agree, and, without intention to deceive, they are apt to seize upon those facts which seem to justify their prejudices, and disregard others of a different tendency. It is to an investigation by scientific men alone,—men who value hypotheses only as they are in accordance with, and serve to account for, facts, and who are ready to abandon them whenever and as often as they are found to conflict with well-ascertained facts,—that we are to look for a satisfactory determination of the causes of these disasters. It might be made the duty of the inspectors of steam-boilers, to keep an accurate record of the explosions which occur in their several districts; they might be authorized to procure an examination in every such case by persons having the necessary scientific qualifications, and required to report at stated periods to an appropriate bureau at Washington. The collating and comparing of the information thus furnished would, doubtless, lead to valuable deductions, and have an important bearing upon future legislation with reference to this subject. In a great majority of the cases embraced in the accompanying Table, it is known that no scientific investigation was had, and the returns, so far as the question of causes is concerned, are probably therefore based upon common report, or the mere opinions of engineers.

(*To be continued.*)

* Encyc. Amer., vol. xiv. p. 652.

† General Report on Explosion, p. 6.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 13TH OF SEPTEMBER, 1849.

None.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Richard Archibald Brooman, of Fleet-street, patent agent, for certain improvements in draught-horse saddles, harness, and saddle-trees. (Being a communication.) September 13; six months.

David Stephens Brown, of the Old Kent-road, gentleman, for certain improvements in apparatus or instruments for the fumigation of plants. September 13; six months.

Henry Attwood, of Goodman's-fields, Middlesex, engineer; and John Kenton, of Bromley, in the same county, engineer, for certain improvements in the manufacture of starch, and other like articles of commerce, from farinaceous and leguminous substances. September 13; six months.

Edme Augustin Chameroy, of Rue du Faubourg St. Martin, Paris, for a new system of railway, denominated (helicoide) heliacal railway, and a circular chariot. September 13; six months.

Apoleon Pierre Preterre, of Havre, in France, for improvements in the construction of coffee and tea-pots, and in apparatus for cooking, and in apparatus for grinding and roasting coffee. September 13; six months.

Edwin Heywood, of Glosburn, York, designer, for improvements in plain and ornamental weaving. September 13; six months.

Robert Griffiths, of Havre, engineer, for improvements in steam engines and in propelling vessels. September 13; six months.

Thomas Marsden, of Salford, machine maker, for improvements in machinery for hackling, combing, or dressing flax, wool, and other fibrous substances. September 13; six months.

Benjamin Goodfellow, of Hyde, Chester, engineer, for certain improvements in steam-engines. September 13; six months.

James Potter, of Manchester, machinist, for certain improvements in spinning and doubling machinery. September 13; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Sept. 6.	2028	Betteley and Co.	Liverpool	Block sheave.
,,	2029	Charles Minshull	Weston-street, Southwark	Imperial hame.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin W. C. Campbell and Co., Hamburgh.

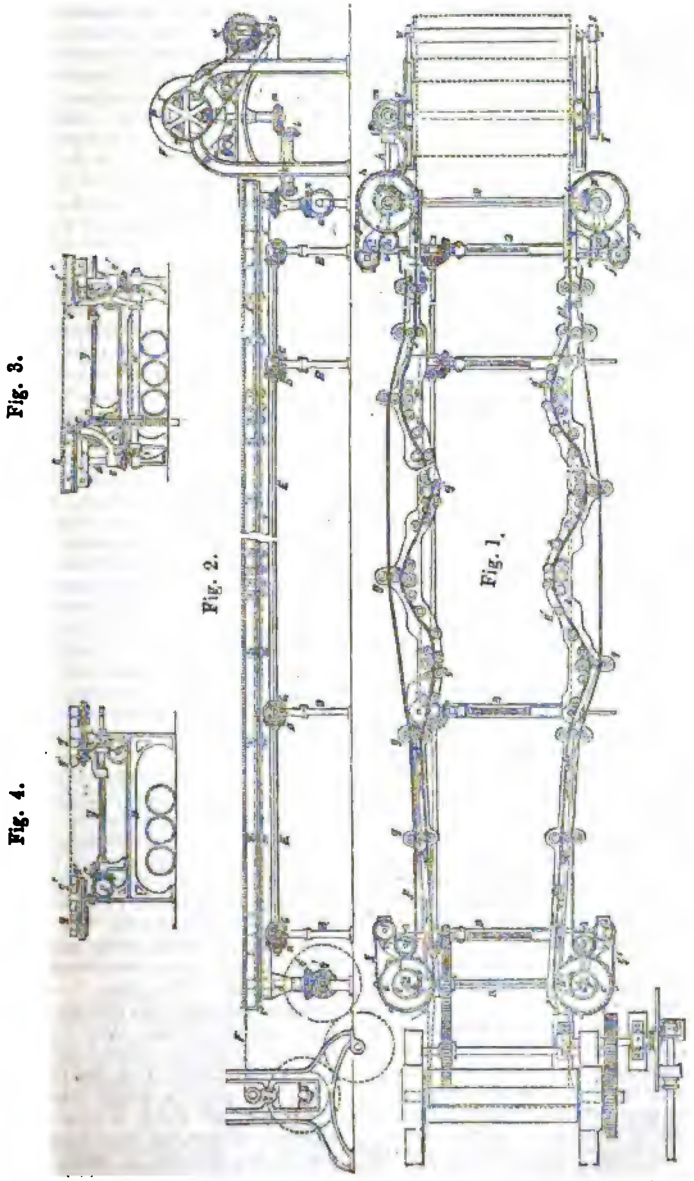
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1363.] SATURDAY, SEPTEMBER 22, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

GRATRIX'S PATENT IMPROVEMENTS IN CLOTH-DRESSING AND FINISHING MACHINERY.



GRATRIX'S PATENT IMPROVEMENTS IN CLOTH-DRESSING AND FINISHING MACHINERY.

(Patent dated March 14, 1849. Patentee William Gratrix, of Salford, Bleacher. Specification enrolled September 14, 1849.)

The improvements embraced by this patent have reference *firstly*, to that description of machinery usually employed for producing upon piece goods the sort of finish known in Scotland as the "Book-muslin finish," and in England as "the Elastic finish," and held everywhere in high estimation for the elastic feel, and straight and smooth appearance which it imparts to the goods. Mr. Gratrix employs for this purpose four several machines or arrangements of machinery—all remarkable for their ingenuity, and all essentially different from those now in use. The first he denominates, from the peculiar character of its action, "The Rectilineal Serpentine Machine;" the peculiarity of which consists in this, that a continuous serpentine motion is given to the warp threads while the weft threads are kept parallel throughout. We extract, from the specification, Mr. Gratrix's description of the means by which this compound motion is produced:—

Fig. 1 is a plan of this machine; fig. 2, side elevation; fig. 3, an elevation of the end, at which the web, piece, or fabric enters; and fig. 4, a cross-section. The machine is represented as working in connection with a mangle.

a is the driving-shaft, to which a rotary motion is imparted by spur-wheels from any convenient first mover; *b b′* are bevel-wheels keyed on the shaft, *a*, which is grooved, and allows the wheel, *b′*, to slide freely on it as required when the position of the frame, *z*, is altered; *c c′* are corresponding wheels, driven by *b b′*, and keyed on the vertical shafts, *d d′*, which work in bearings attached to the framing of the machine. The grooved pulleys, *e e′*, are fixed on the shafts, *d d′*, and impart motion in the directions indicated by the arrows, to belts or straps, *f f′*. The upper edges of these belts or straps are furnished with sharp steel points for taking hold of the piece, web, or fabric, and the selvages are pressed upon the points by attendants as the web comes from the mangles. On their lower edges are narrow welts of leather, which pass beneath the edges of the guiding pulleys, *g g′*, or in grooves which may be formed in all or some of them, and thus prevent the straps from rising; these belts or pulleys, *g g′*, rising on studs, which are adjustable in slots made for the purpose in the framing of the machine. These pulleys, *g g′*, are so arranged, as with the assistance of fixed grooved longitudinal supports, g^2, of hard wood or other suitable material, to guide the straps or belts, *f f′*, for some distance in straight lines diverging from each other, but afterwards in a sinuous course, which is continued to any extent, according to the finish desired. On the finish being attained, the straps or belts proceed in a straight direction, and nearly parallel with each other, to the pulleys, *h* and h^1, which are keyed on vertical shafts, $i\, i^1$, and work in bearings similarly with the shafts, $d\, d^1$. Then passing round, and imparting motion to the pulleys, *h* and h^1, the straps or belts lead round the tightening and nipping pulleys, *j* and j^1, back to the pulleys, *e* and e^1. In order to avoid the possibility of any slip occurring between the straps or belts, $f f^1$, and pulleys, $e\, e^1$, it may be necessary to make use of pins projecting at equal distances from the circumference of the pulleys, $e\, e^1$, and taking into corresponding holes in the straps or belts, $f f^1$, as shown by dotted lines. A thin board interposed between the lower edges of the pulleys, $g\, g^1$, and the upper surface of the framing, prevents any injurious communication of heat from the latter to the straps. The guide pulleys, g^1, which work beneath the web, piece, or fabric, are made in the form of inverted frustums of cones, in order that when their outer sides are placed vertical, (that is, in coincidence with the strap,) their upper surfaces shall not rub against the under-side of the web, piece, or fabric. The bevel wheel, j^2, is keyed on the vertical shaft, *i*, and gears into a corresponding bevel wheel on the shaft, *k*, to which it imparts motion. The wheel, *l*, is also keyed on the shaft, *k*, and gears into a wheel, *m*, made fast to the vertical shaft, *n*. The wheel, *o*, fixed on the upper end of the vertical shaft, *n*, imparts motion to the cylinder, P, by means of the wheel, *q*, fixed on its axis. The cylinder, P, may either be heated by the introduction of steam in the ordinary manner, or otherwise, as convenient. The pulley, *r*, which is also keyed on the axis of the cylinder, P, imparts motion by means of a strap and pulley, *s*, to a wooden drum, *t*; above which, and resting on the cylinder, *t*, is the roller, u^2, on which the piece is wound when finished. The roller, u^2, which is weighted in the ordinary manner, and resting on the upper part of the cylinder, *t*, causes the rotary motion of the latter to be communicated to the former for winding on the web, piece, or

fabric. The slots, v, allow the roller, u, to rise as the web, or piece, or fabric is wound on. $u\,u^1$, are guide rollers, which guide it into contact with the cylinder, P. The lower side of the roller, u, is placed somewhat higher than the level of the steel points, in order that the web, piece, or fabric may be raised clear of them before it arrives opposite the centre of the shafts, i. To ensure a perfectly simultaneous movement of the pulleys, p and p^1, they are connected with each other by the shaft, w, (which, like the shaft, a, is grooved and keyed, to admit of the sliding movement needful in adjusting the frame for various widths of cloth to be operated upon) and bevel-wheels, x. The machine is made adjustable to suit fabrics of various widths by means of the screws, y, which work into nuts attached to the moveable frame, z, which is furnished with wheels, A, which rest on the fixed standards, B. The motion of the screws, x, is rendered simultaneous by means of the bevel-wheels, C, which are keyed on to them, and take into corresponding wheels, D, which are keyed on to the longitudinal shaft, E. The requisite amount of heat is supplied by steam, hot air, or hot water pipes.

The dotted lines in the engraving represent the piece, web, or fabric, which is lettered F, as passing through and from the mangle, and show the relative positions of the warp and weft threads during its passage through the machine. It will be observed that both edges of the piece are made to travel simultaneously and continuously forward. The weft threads are consequently kept throughout in a parallel position to that in which they enter the machine, while those of the warp are carried for the most part in a sinuous or serpentine course.

The second finishing machine is called "The Segmental Curvilineal," and the third "The Longitudinal Curvilineal;" the fourth is but a modification of the third. All three possess in common this distinguishing feature, that a motion is given to the centre of the piece quite distinct from, though auxilliary to, the motion of the edges.

Claims.

1st Machine.—The improvements which I claim in respect of this machine or machinery are, the giving of a combined serpentine and rectilineal motion to the web or piece or fabric,—while in the course of being dried and finished; that is to say, a continuous serpentine motion to the warp threads, while the weft threads are kept parallel throughout; and so many of the parts of the said machines or machinery as are necessary to produce such combined serpentine and rectilineal motion.

2nd Machine.—The improvements which I claim in respect of the segmental curvilineal machine, are, the attaching of the carrying belts or straps to the web or piece in such a manner as to cause it to sag or curve at the centre; and the employment of revolving segments to move the centre forward at intervals, in advance of the edges, and while the edges are in continuous motion. I claim also the application of the above movement to the stretching of woven fabrics.

3rd and 4th Machines.—The novelty which I claim in respect of the "longitudinal curvilineal machine," and of the modification of it described, is the causing, by means of longitudinal rails and parts in connection therewith, the centre of the web or piece to move intermittently in an advancing or receding, or advancing and receding curvilineal direction, while the edges are moving continuously straight forwards.

Mr. Gratrix shows also how "the longitudinal curvilineal movement" of the third and fourth of the preceding machines may be adapted to the common clamp or table frames now in use, for the purpose of producing the ordinary rigid finish, so as to enable them to produce the elastic finish :—

A longitudinal rail, the length of the tenter frame, is suspended by levers fixed above it, one or more of which are keyed upon shafts, to which motion is imparted by any suitable first mover. The piece or web, or fabric is fastened by pins or clamps, at each edge, to the frame sides, and hangs down freely between them. The rail or bar is let down into contact with it, and a radial curvilinear motion imparted; by which, in conjunction with the application of heat in the usual manner, the finishing is effected.

Mr. Gratrix claims this "application of the longitudinal rail movement with the common clamp or tenter frames, as before described, for the purpose of producing the elastic finish."

Mr. Gretrix describes, secondly, certain improvements in the method or process of finishing pile goods, such as velvets, velveteens, cords, &c.; his "claims" in respect of which are thus conceived :—

"What I claim more particularly in regard to this finishing-machine is the employment of the cylinder moving continuously in concert with, or at a greater or less speed than the web or piece, while tools

revolving on different axes are acting on the outer circumference of the web or piece, as described.

"I claim also the application to the finishing of pile goods of the cylinder and revolving tools, as described, combined with stationary tools, or fixings which do not revolve, but are adjustable by suitably applied weights or springs; also the revolving cylinder, above alluded to, combined with the non-revolving tools only; also the employment of a cylinder not revolving, but over the periphery of which the web or piece travels, and is, at the same time, acted upon by revolving rollers or stationary tools, as described.

"I claim farther as my invention the revolving tools, and the peg, or grit, and emery-roller, in so far as regards the spiral form given to the same, of whatever breadth or pitch the threads of the spiral or screw may be used."

ON THE MASTING OF SHIPS.

(Continued from page 250.]

2. *Form of midship section.*—I have said the resistance of the water may be divided into two portions,—one, that which the vessel offers to being driven sideways; and the other that which she offers against being driven endways, or ahead. The former being a constant, the position of the centre of effort will vary with the form of the midship section;—for in proportion as the midship section—which gives a character to all the other sections—falls in, below water, and out above, as the vessel inclines, the immersed breadth on the lee side will be increased, and that on the weather side decreased; but the resistance being proportioned to the immersed breadth on either side of the middle line, that on the lee side will be greater, the effect of which excess will be to turn the vessel from the wind, to counteract which the centre of effort will require to be placed further aft,—further aft as compared with a vessel that has a perpendicular side near the load water-line.

Fig. 1.

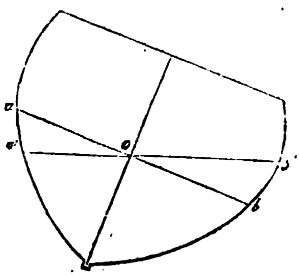


Fig. 2.

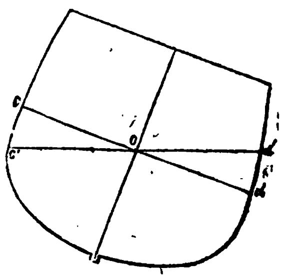


Fig. 3.

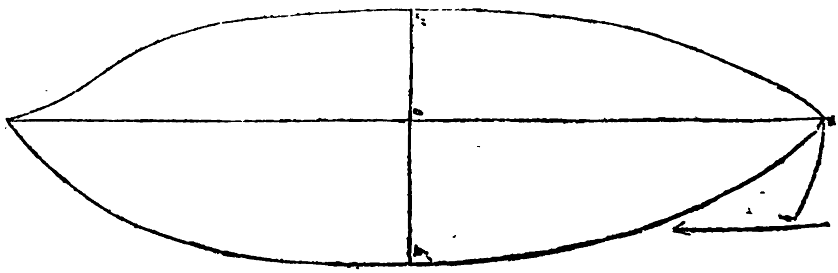
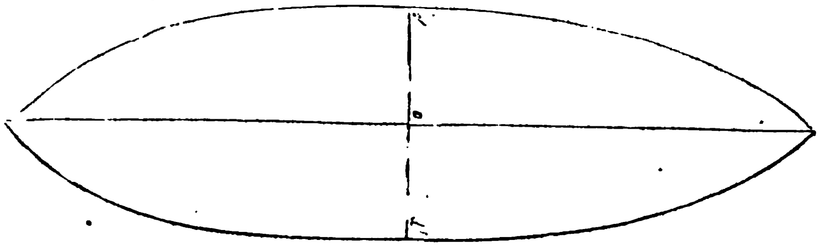


Fig. 1 is the midship section of a vessel inclined to $a' b'$; fig. 3 is a plan of the same, under similar circumstances—$a' ab'$ being the situation of that section. When fig. 1 is upright, the two parts, ab and ob, of the load water-line, are equal;

Fig. 4.



but when inclined, $a'o$ is considerably less than ab': not so, however, those in figs. 2 and 4, where they are equal under each circumstance. Obviously, then, as fig. 3 is moved ahead, the greater resistance on ab' than that on $a'o$ will tend to turn her round from the wind, the tendency being for the stern to pass over the dotted line, xy, consequently, she will require the centre of effort of sail further aft than fig. 4 to correct the above-stated tendency.

3. *Form of bow.*—In proportion as the bow is short, its tendency will be to accumulate the water in the path of the vessel, and thence proportionally prevent it from flowing along the side of the vessel; by this the pressure far forward will be increased, and that aft decreased; and so the resultant of the water will be carried forward. Such a form, then, will require that the centre of effort of the sail shall be carried forward a quantity proportional to the shortness of the bow. That this is the case is shown by the fact, that vessels with short bows carry a more than ordinary amount of weather below; because the greater immersion of their lee bow, when they are inclining, in strong winds, carries the resultant of the water forward.

4. *Form of after-body.*—It is found that the water cannot turn in behind a vessel quickly near the surface, the force to cause it to do so being proportional to the depth; so the body of the vessel may be advantageously filled at that part, and being so, will increase the lateral pressure of the water, which will carry the resultant of the water proportionably aft; consequently such a form will require that the centre of effort of the sail should be further aft a like quantity.

It is contended by some, on the other hand, that a fine after-body carries the resultant of the water aft, and by some persons that a full after-body injures the speed—both cannot be true.

5. *Longitudinal stability forward:* or power to resist inclination lengthwise. This depends, for the most part, upon the position of the centre of gravity (in the horizontal plane), and may be treated of as if it wholly depended upon that.

This power will be small in proportion as the centre of gravity is situated far forward—it will be furthest forward with the shortest and *most full bow;* having premised that the height of the centre of effort of sail in the navy is selected with reference to the lateral stability, and classification of masts and yards, rather than to the form of the vessel forward and aft. If this height be too high for the form, and the longitudinal stability be small, the sails will press the ship down forward, immerse the lee-bow more, and raise the ship aft; by all three the centre of resistance of the water will be carried forward, and such a form will require that the centre of effort of the sail should be carried forward proportionably.

Great longitudinal stability is one of the points of most value that is derived from great proportionate length.

I would commend the above to "B. T."

6. *Small lateral stability.*—As before stated, the amount and height of sail depending upon classification it will occur that vessels of different moments of stability will be found with equal moments of sail. When a vessel inclines, the centre of effort of the sail is carried over to leeward of a plane vertical to the centre of gravity; the effect of this is, that the sail acts through a lever equal to the perpendicular distance of its centre from the centre of gravity to turn the vessel round, the head towards the wind; and

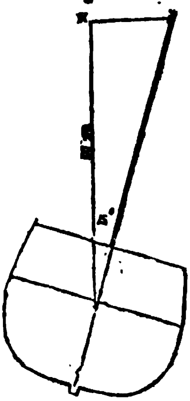
as the vessel with least stability will incline most, so the effect in her will be greatest, and she will require to have her centre of effort of sail furthest aft.

It is obvious, from the above, that if two vessels have their masts placed similarly, and they be generally of the same form, and that in one of these the masts prove to be much too far aft, it proves that one, to have much less stability than the other.

The stability alluded to is the total effective stability, that is the statical and hydro-dynamic, inclusive.

Suppose fig. 5 to represent a section of a vessel with the centre of effort, *x y*, of

Fig. 5.



the sail 50 feet above the deck, and she inclining 15°, *y* will be the height of the centre of effort, *x y*, the distance it is from a perpendicular to the centre of gravity. Fig 6 is a plan of fig. 5; *x′ y′*, is the lever, through which the sails act, tending to turn the ship round, head towards the wind; in such case the stern would pass over the dotted line.

7. ***Ratio between the area of the vertical longitudinal and vertical transverse sections.***—If the former be small and the latter large in proportion, the vessel will be driven to leeward a greater quantity, and, consequently, the resultant of resistance will be brought aft, and therefore will require that the centre of effort should be brought proportionally.

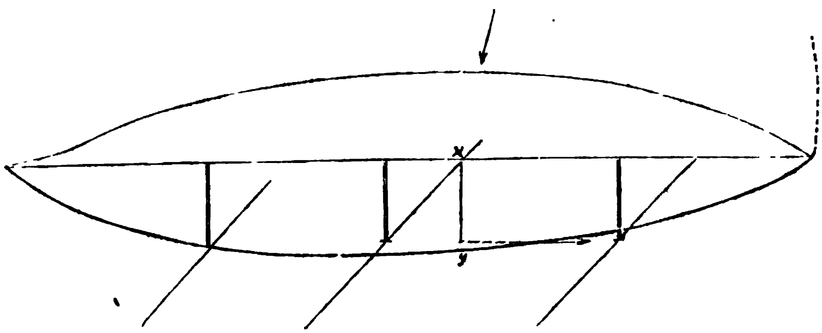
If the latter be small in proportion, the reverse effect will take place, and the opposite adjustment will be required.

The *Queen*, before she received false keel, stern and stern-post, was an illustration of the correctness of the former.

The substance of the foregoing is, that the correct position for the masts cannot be arrived at by any amount of calculation, until the law of resistances be known. We shall be able only to define their approximate position except by experiment, and though this be so, our experience is practically thrown away, for want of a classification and registry of the experiments upon some definite and satisfactory plan.

From the foregoing arguments it is evident that nearly all the ships in the

Fig. 6.



navy would be improved by being sailed more by the stern than is provided for, only that the centre of effort of the sail must be brought aft proportionably, except indeed it be too far aft at the present trim, and except such ships as are now

sailed much by the stern, as the *President*, *Ganges*, *Daring*, and others somewhat similar.

Where the centre of effort of the sails is too far aft it were better, and more economical, to trim the ship more by the stern, and keep the masts upright.

In bringing a vessel by the stern the resultant of resistance is carried aft, and the stability is increased, both lateral and longitudinal (forward). The effect of the latter is to give her some of the advantages of greater length without any of its disadvantages.

The position of the masts should be tabulated in reference to the centre of gravity and the centre of the vertical longitudinal plane, and not as is now so often absurdly done, in reference to their positions on the load water-line.

F——.

THE BRITISH ASSOCIATION.—BIRMINGHAM MEETING.

(Selections from the *Athenæum* Report of the Proceedings.)

Manufacture of Sugar.

Paper read, on the combined use of the Basic Acetates of Lead and Sulphurous Acid, in the Colonial Manufacture and the Refining of Sugar, by Dr. Scoffern.

Dr. Scoffern, after a few preliminary remarks on the anomalies which beset the colonial sugar-manufacturing functions, stated the actual amount of pure white and crystallizable sugar existing in the sugarcane juice to be from 17 to 23 per cent., and the amount of juice contained in the cane to be about 90 per cent.; of this amount only 60 per cent. on an average is extracted—and of this quantity only one-third part of its sugar is obtained, in a dark impure condition, instead of white and pure as it might be extracted. The operation at present generally followed in the colonial production of sugar involved the use of lime; an agent which although beneficial in seperating certain impurities and decomposing others, effects both these agencies at the expense of two-thirds of the original sugar. Curious plans had been followed to avoid the use of lime:—alumina, in its hydrated condition, had been employed, but with inconsiderable success. As a purifying agent the basic acetate of lead was known to be most potent, but could not be generally employed, owing to the existence of no sufficient means of separating any excess of that agent which might remain. Dr. Scoffern effects this separation by means of sulphurous acid forced by mechanical means into the sugar solutions. The process had been used for more than twelve months in one of the large British refineries, and a lump of sugar prepared by means of the operation was exhibited. The advantages presented by this operation were thus summed up:—1. As applied to cane-juice, and other natural juices containing sugar, it enables the whole of the latter to be extracted instead of one-third, as is now the case: and in the condition of perfect whiteness, if desired, without the employment of animal charcoal. Owing to the complete separation of impurities the juice throws up no scum when boiled, and therefore involves no labour of skimming. Finally, the process of curing is effected in less than one-third of the present time—and the quality of the sugar being in all cases so pure and dry, no loss in weight occurs during the voyage home. 2. As applied to the refinery operation, it enables the manufacturer to work upon staples of such impurity that he could not use them on the old process. It yields from these staples a produce equal in quality to the best refined sugars produced heretofore—in larger quantity, and in less time. It banishes the operation of scum-pressing, the employment of blood and lime. Finally, its cost is even less than that of the present refinery process.

The Electric Light.

Paper read, on the comparative Cost of making various Voltaic Arrangements, by Mr. W. S. Ward.

The author stated that a series of calculations founded on data, produced to the Chemical Section at Swansea, showed the efficient power of three generally-used forms of battery known as Smee's, Daniell's, and Grove's, would be equal, when 100 pairs of Smee's, 55 pairs of Daniell's, or 34 pairs of Grove's were used, and that the expense of working such batteries as regards a standard of 60 grains of zinc in each cell per hour, would be about 6d., 7½d., and 8d., respectively.

This communication led to conversations on the economy of the electric light and electro-magnetic engines, in which Dr. Faraday, Mr. Shaw, Mr. Hunt, Mr. Elkington, and other gentlemen joined. Dr. Faraday remarked on the imperfect character of electric light, and its inapplicability for purposes of general illumination; all objects appearing dark when the eye was embarrassed by the intensity of the electric arc. Mr. Shaw and Dr. Percy instanced the magneto-electric machines which are employed at Birmingham for

electro-plating, in which the current cost of the motive power; viz., a steam engine to put the magneto-electric machine in action, was the only working cost. Mr. Elkington stated that they had never been induced to abandon the voltaic battery which they employed in their manufactory, finding it more economical than the magneto-electrical machine of which he was the patentee. He also stated the remarkable fact, that a few drops of the sulphuret of carbon added to the cyanide of silver in the decomposing cell, had the property of precipitating the silver perfectly bright, instead of being granulated so dead as it is when thrown down from the solution ordinarily employed.

Growth of Silk in England.

The following letter was read from Mrs. Whitby:—

"Birmingham (Newlands).

"I had proposed offering to the British Association a short account of my progress in the art of cultivating silk in England; but I left Newlands before all the produce of this year could be wound off from the cocoon; and it will not, therefore, be in my power to make my report as full, or as statistical, as I could desire. I am, however, unwilling that this meeting should pass, without endeavouring in some way to satisfy the expectations of those who have been sufficiently liberal to pay regard to my convictions, that the cultivation of silk may with little trouble or expense be made general, and in the end become a profitable speculation. From the period when I had the honour to place before you an account of my early trials, I have paid attention to the cultivation of the mulberry, especially of that species which I introduced in 1846, viz., the *Morus multicaulis* of the Phillippine Islands. I have three other kinds of white mulberry, which all grow well at Newlands; but as none are so easily propagated as the *multicaulis*, or bear so great a weight of leaf, I have increased my plantation with them chiefly. I said, in my letter to the Royal Agricultural Society in 1844, that it was as easy to do so as to propagate the willow. I now say, that it is much easier, and the produce is more abundant. The produce of leaf this year has been immense; and even now, after having plucked them closely to feed my silkworms, they are strong and vigorous, and present a luxuriance of growth scarcely to be credited—unseen. I find the cuttings which are rooted in the open ground produce stronger and healthier plants than those struck under glass. One of my early pupils has a productive nursery, at Godalming, of the *Morus alba*—many others in different parts of England are planting; and if gentlemen in England and Ireland who have a few acres or roods of land to spare would plant mulberries for posterity as they do their oaks, we should, in a few years, be independent of other countries for our supply of raw silk. With regard to the rearing of the silkworm—as their habits become more practically known to me, I find less and less difficulty in bringing them to perfection, and am confirmed in my belief that, with due attention to their peculiarities, they may be reared in England as easily as in any other country, and with as little loss by death. Equable warmth throughout the period of their existence (which may be shortened or prolonged at pleasure), cleanliness, classification, and ventilation, with the adaptation of the food (as to its maturity) to the different ages of the insect will insure success. I have been this season very successful in rearing the worms I was able to hatch; they had no disease of any kind—they made their cocoon in thirty days, and the silk I have been able to wind off is as strong, and bright, and beautiful as that which, in 1844 and 1845, was pronounced superior to the best Italian raw silk. There are many persons in England, and a few in Ireland, who have begun the experiment on a small scale. It requires time to mature and perfect any undertaking; but, if I live long enough, and the growth of the mulberry becomes generally encouraged, I have no doubt my ardent wish to see the cultivation of silk established in England will be realized.

"M. S. S. Whitby."

Superiority of Macadamised Roads.

A paper on this subject, by Mr. J. P. Smith, was read:—

There is a prevalent feeling against the employment of broken stone roads for streets, because, as they are usually managed, they are the cause of great inconvenience to householders and others by the dirt and dust they occasion, and also because their maintenance and repairs are very expensive, while the draught of vehicles upon them is very heavy. The object of this paper is to prove, from long-continued experience on a large scale, that those objections do not necessarily accompany the use of such roads. In discussing this question the interests of two parties must be considered: those who principally use the road, the owners and employers of horses and vehicles—and those who pay for it, the ratepayers, who are they who would be injured and annoyed if it were unduly expensive or unnecessarily dirty, dusty, and noisy. It is a common error to consider that road the cheapest which costs the least in direct ex-

penditure. If, however, this so-called cheapest road causes waste of horse-power, undue wear and tear of horses and vehicles, loss of time by being unfit for sudden transit, and occasions loss to the inhabitants by filling their dwellings with dust and covering their clothes with dirt, it is evident that such a road is really very dear. There is an apparent diversity of interest between those who use and those who pay for our public streets; as the principal loss from bad roads falls directly upon those who keep or employ horses and vehicles, while the expense of road repairs falls upon the inhabitants generally. A little consideration, however, will show that this diversity of interest is more apparent than real. It is the interest of all that there should be easy, safe, and cheap means of transit through the public streets; and any increase in the cost of transit is a source of indirect expense even to those who have no horses of their own, as it must add to the cost of everything carried through the streets, and of all hired vehicles, and of all the numberless conveniences which accompany residence in a large town. It must also be remembered that it is very wasteful to allow a road to go out of repair, since it is less costly to keep a road up than to restore it. That roadway is best for the owner or user of a horse or vehicle which can be travelled over most easily, safely, quickly, and cheaply; and that ease, safety, speed, and economy are to be obtained by having the road firm, even, and smooth, and perfectly free from mud or dust, or any form of unattached materials. It is evident that the same qualities will render the roadway most free from noise, dirt, and dust; the three great causes of annoyance and injury to the inhabitants of all ordinary streets. The question which remains to be considered is, whether the advantages of good roads to the inhabitants generally are worth their cost? If the question had to be decided in accordance with the interest of the users and owners of horses merely, no doubt whatever would be entertained. Of whatever nature the surface of a road is to be, it is essential that its foundation should be of firm material, well consolidated, and perfectly drained; if not, the crust becomes loosened and destroyed, the road is rough and uneven, and wears into holes and ruts. Having obtained a good foundation, the next point is to cover it with a hard, compact crust, impervious to water, and laid to a proper cross section. The stones must be broken to one regular size, well raked in, and fixed there by a binding composed of the grit collected in wet weather by the sweeping-machines and preserved for this purpose. This binding must be laid on regularly, and watered until the new material is firmly set, which it will do very quickly and with the regularity of a well laid pavement. The sharp angles of the stones are preserved, and there is both great saving of material and a firmer crust formed than by the common method of leaving the material to work into its place without the use of binding—in which case the angles of the stones are worn off and reduced to powder, and at least one-third of the material is wasted in forming a binding in which the stones may set. By the improved method the binding is formed of material that would otherwise be useless. Many road-makers object to the use of binding, on the ground that the road is rendered rotten by it, and that when the road is set it has to be carted away again. This is apt to be the case under bad management; and when ordinary soil is used, the fine particles of which work it into mud and keep the road from setting firmly. But the coarse grit obtained by the sweeping-machine off the roads is the very same material as is produced by wearing away the angles of the stones, and when judiciously applied to a new coating it will speedily become as well consolidated and firm as an old road. In the common method not only is there great waste of material, but the loose stones occasion delay by their resistance, great fatigue to the horses and danger to their feet, while the noise produced by their grinding together is annoying to the inhabitants. Upon the improved method the inconveniences of road repair are incomparably less than those of pavement. Both recoating and repairs may be made without stopping the traffic. Under no circumstances must any imperfection of surface be allowed. If a hollow be not immediately stopped it very quickly extends over the surface. All loose stones should be carefully picked, as every loose stone passed over by heavily-laden carriages, if not ground to powder, breaks the crust of the road, and if water be permitted to lodge on the surface it will cause great mischief. It is the neglect of these essential precautions that has led many to consider macadamized roads expensive. They *are* expensive if neglected. On a well-made road heavy showers do good, by cleansing them; so, also, does artificial watering if the road be clean or swept quickly after it is watered. A road which is perfectly dry loses its tenacity and the surface grinds into dust; whence the economy of judicious watering in hot weather, which preserves the road as well as prevents the annoyance of dust. The practice so common in London and elsewhere of heavy watering a dirty road without cleansing it, and thereby converting

the dust into mud, is very injurious to the road, and merely changes one nuisance into another—dust into mud. A great source of waste, both to those who use and to those who repair a road, is to allow it to be dirty. The draught on a dirty road is twice as heavy as on a clean one—that is, a horse must exert double force to draw his load with the same speed. The cost, however, of employing double force is so great, that the expedient of diminishing the speed is generally adopted, as a horse can exert greater pulling force at a slower pace,—less power being required to carry his own body. It often happens that the extra resistance occasioned by dirt diminishes the speed one-fifth or one-fourth. The effect of the dirt, therefore, is to increase the work by twenty or twenty-five per cent. It will easily be believed that such a waste far exceeds the cost of the most perfect cleansing. This is the case when cleansing is done by scrapers (the greatest enemy a macadamized road has to contend against). By their use the stones are dragged from their places, and the adhesive dirt is not effectually taken away. Sweeping is the only mode of cleansing that should be allowed, either on streets or on turnpike-roads. Sweeping by the wide brooms of Mr. Whitworth's machine is preferable to all other modes of cleansing yet tried. It must be evident, that the fact of these wide brooms sweeping longitudinally, with a pressure that can be adjusted according to circumstances, tends powerfully to preserve the road and to consolidate its surface. They press most upon the ridges, and least upon the hollows, thus tending to reduce the former, and fill up the latter. When the dirt is stiff, and adheres firmly to the stones, it should first be well watered, when it may be completely removed by the machine, without disturbing the crust, leaving the surface firm and compact. The use of water for this purpose has been objected to by high authorities, on the ground that it *does* remove the useful grit; but the contrary has been proved by ample experience. I have found that the use of the sweeping-machines, with the proper employment of water, has reduced the amount of material required for the repair of roads in Birmingham one-third—namely, from about 20,000 to 13,000 cubic yards. The first-named amount is the average for seven years preceding the introduction of the machines,—the latter of the three years subsequent. I communicated these details to a friend in London, and he determined to test their correctness. The following is the result of his experiment to settle whether useful grit was or was not removed by water and machine sweeping. On the 22nd of March last, the Quadrant, Regent-street, was covered with a thick layer of dirt, which was causing great annoyance as well as injury to the road, but could not be removed by scraping without removing also much of the new stone to which it adhered. It was determined to sweep half of it dry, and half after proper watering. This was done, and the sweepings removed were washed, to separate the refuse from the stony matter mingled with it. One third part of that which was taken dry, consisted of coarse grit, which would have been useful on the road—one-twelfth part only of that which was removed in the form of slop was stony matter; and that was so completely pulverized, as to be of scarcely any use;—it had done its work. After the two portions of the road had been cleansed, the difference between them was very striking. That which was swept dry was still covered with adhesive matter, which was lifted by the wheels, together with the stones to which it adhered, the whole road being rough and uneven; the portion which had been swept with water was perfectly even and smooth. On the 24th both portions were swept, but only one quarter as much dirt was taken from that which had been water-swept as from the other. On the 26th it rained, and three times as much slop was taken off the part of the road which had not been water-swept on the 22nd. The preservative effect of water machine sweeping was most evident by the decidedly better condition of that portion of the road cleansed in this effective manner. The great objection urged against macadamized roads for streets is the annoyance by dust and dirt which they occasion, and many persons prefer submitting to the deafening noise of pavement in order to avoid these; but this would not be the case if water and machine-cleansing was adopted, the cost of which would be saved in diminished wear and tear. The entire cost of cleansing and watering Birmingham is about 5,000*l.* per annum,—or less than one penny per week for each of its inhabitants. It has been objected to macadamized roads that the draught upon them is heavier than upon pavement;—and with carriages altogether similar this is the case, and especially so with vehicles travelling slowly. But it must be remembered that the proportion of the draught is only one of the circumstances by which the labour of the horse is to be estimated. Another very important consideration is the surface which gives the horse the safest footing; and his footing on pavement is so much less secure than upon a good broken stone road, that he does not receive the full advantage of the smaller draught. Again, carriages—especially those travelling

quickly—are exposed to much more violent concussions upon pavement than upon a smooth macadamized road; consequently, not only must the carriages be stronger, and therefore heavier, but the increased frequency and violence of the concussions consume a larger portion of power, which goes far to counterbalance the diminished friction. There can be no doubt that the wear and tear of both horses and vehicles is far greater upon pavement than upon macadamized roads. In reckoning the real cost of a road, all expenses attending its use should be calculated; and if this were done, pavement would be perceived to be exceedingly expensive. Carriages roll so smoothly over a well-maintained macadamized road, and horses are so little injured either by falls or strains, that I conceive the wear and tear upon them is not half of what it is on pavement.

SIR SAMUEL BENTHAM'S VERMICULAR BARGES—INDIAN STEAM NAVIGATION.

Sir,—On reference to the *Mechanics' Magazine*, No. 1362, it may be observed that the articulation of Mr. Bourne's barges for East India navigation, their shallow draught of water, and the application of wheels to them, are so analogous to similar particulars of Sir Samuel Bentham's vermicular vessels, and his amphibious carriages, as to have led to the supposition that the articles in the *Mechanics' Magazine* respecting these inventions, had suggested the adaptation of similar contrivances to the navigation of East India rivers; but Mr. Jackson explicitly states that Mr. Bourne was altogether unacquainted with those inventions of Sir Samuel's. This therefore shows how true was an observation made in No. 1338 of the *Mechanics' Magazine*. In speaking of the Pentonville Penitentiary there was occasion to say, that "the seats for the prisoners when present at Divine service are constructed precisely in the same manner as they were designed" (by Sir Samuel for the intended Panopticon Chapel, 1793") and in the note, p. 298, it was observed, that "*when two men of ability have it in view to produce the same effect, they frequently invent identical means of effecting their purpose.* The seats and screens for the prisoners are similar to those invented by Sir Samuel, of which a drawing made in the year 1793, still exists." "Yet there is no reason to suppose that Colonel Jebb ever saw those drawings." So it appears that Mr. Bourne and Sir Samuel have invented, *separately*, the same means for navigating shallow tortuous rivers.

The success with which Sir Samuel's vessels were attended, is confirmatory of Mr. Bourne's views, as exhibited in his published Report. But it may be asked, —If articulated shallow trains were so advantageous, why has their use not been continued in Russia? Sir Samuel immediately after their construction was selected to create and arm a flotilla at Cherson, and then to command the first division of it in the Liman of Otchakoff,* where in three days' engagements his flotilla overthrew a more numerous Turkish one, took one ship of the line, sank another, and burnt seven more; his promotion for this service, and selection of a command in Siberia, entirely precluded further attention to the vermicular vessels. Lord St. Helen's and the Count de Segur (both of them in the year 1787, Ambassadors from their respective Courts to that of St. Petersburgh), having been on board of the *Imperial Vermicular*, had at different times before their death spoken in my presence of her; and it is to be regretted that no record has been preserved of details that from time to time have been elicited respecting the advantages of Sir Samuel's reticulated vessels, as such particulars would have tended to confirm the eligibility of Mr. Bourne's trains, navigated as they would be by steam power.

M. S. B.

THE LINES OF THE "CANOPUS."

Sir,—It is stated at p. 177, of your present volume, (see diagram, fig. 9,) that the breadth of *Canopus* at *s s*, lowest section near the keel, is a shade less than at A B, the surface or load water-line; in other words, that she is a straight wall-sided ship below the water surface, like an old Indiaman.

Many years ago I saw the *Canopus* in dock at Plymouth, and my recollection is distinct that she had a well-defined French bottom. The flat floor of such vessels seldom exceeds half their main breadth, and there is commonly a quick curve at the junction of the floors and timbers with a regular curve to the

* See *United Service Journal*, 1829, pt 2, p. 333.

surface of the water. On the contrary, in heavy ships of war the old English form of midship section had a much broader flat floor, about three-fourths of the main breadth with a quick curve below, and less curved sides to the load water-line.

If my views are correct the breadth of *Canopus* at *s . s*, would not exceed, perhaps not quite amount to, 40 feet, (see section 9). Small diagrams are apt to mislead; but as truth is a public object, perhaps your correspondent would be kind enough to state in figures the depth below load water-line of the several sections, *a b*, *s s*, &c., &c., and also whether *Canopus* has the French or old English midship section.

Sir W. Symonds's vessels are usually constructed with a straight rise of floor, and a quick curve just below the surface of water, and not with the curved floor of the diagram, and the small amount of breadth, 46 feet, *a b*, which requires confirmation—or rather the depth below surface; so that any person may lay a larger scale as the midship section required.

I remain, your obedient servant,

Z.

September 12, 1849.

MECHANICAL REVIVALS.

The newspapers of the past week—the *Times* leading the way—have called in a very prominent manner the attention of the public to two "new" and wonder-working inventions—the one a rotary engine, "*the invention* of Captain W. E. Fitzmaurice, late of the 2nd Life-Guards, and his brother-in-law, Mr. Halford;" the other a patent steam-generator, "*invented*" by a Mr. Wright.

The rotary engine has been reclaimed in the *Times* by the ingenious Mr. Elijah Galloway, C.E., as being the identical rotary engine last patented by him (December 14, 1846), and in which he has merely given Captain Fitzmaurice a *proprietary* interest for certain moneys had and received. The newspaper paragraphs mentioned that the Captain had (much to his honour!) "given the invention freely to the public." A smart way this of achieving eminence as an original inventor and public benefactor!

Mr. Wright's steam-generator is, in like manner, nothing more nor less than the cellular steam-generator of Mr. W. H. James, the clever son of the clever but sadly ill-requited JAMES, to whom, more than any other man, belongs the merit of having originated the modern railway system, (*see Mech. Mag.*, vol. xlix., pp. 401—500,) —which cellular generator was patented years ago by Mr. James, and fully described in this Journal (vol. xlviii., p. 471). Mr. Wright's right to identify himself with this invention is just no right at all; or, at best, some such parchment or paper title, as that which Messrs. Fitzmaurice and Halford may, but do not boast of.

We must not, however, allow the false colours under which these Revivers spread their canvass to the wind, to prevent us from recording what the two inventions referred to, are stated to have accomplished in their resuscitated state.

Of the rotary engine we have this account:

> It was fitted up in a frigate's pinnace, 10 tons burden, carrying 5½ tons, and though calculated at 10-horse power, occupied only 21 by 7 inches. The boat is 32 feet long and 8 feet broad in the beam, and though intended to mount carronades and carry men, was not fitted for speed; she is propelled by a screw, 3 feet diameter, worked by the engine, which made 200 revolutions per minute, and the boat 2 miles in 20 minutes, or 3 miles per hour. The working parts of the engine are most simple, consisting only of two pieces, which work with the greatest ease, are free from any dead points, and without the slightest vibration, however high the velocity. There are no springs or packing; and the motion being a rolling one, there is little friction, and the works will last a great length of time without repair. It weighs less than 1 cwt. per horse power, and requires much less fuel than other engines. . . The boat started against the stream with seven persons on board in fine style, and on Mr. F. P. Smith timing the revolutions of the screw, he found them to be 192 per minute, and that may be considered the average speed on this occasion, with a very little exception, when the screw got entangled in weeds, which were soon removed when found adhering, by a few back turns of the screw. The distance run out and back was about 26 miles, and once through the lock of a canal; for which species of navigation it appears to be admirably adapted, having shown on a previous occasion its capabilities for towing, by drawing a broad-bowed and flat-bottomed barge, 30 feet long by 12 feet in breadth, at

the rate of three miles an hour against the stream. The speed attained by the boat on this occasion was ascertained by Mr. F. P. Smith and Captain Houston Stewart to be fully seven knots per hour, or 8·055 statute miles an hour—a remarkable result, considering that the boat was in no way constructed for speed. The ease with which the engine could be set in motion, and stopped or graduated to any degree of velocity up to its full speed, was a subject of surprise to the visitors, and the rough manner in which it was used to show its instantaneous effect, and difficulty to put it out of working order, could not be credited unless they were witnessed. The absence of vibration in the engine, and the uniform continuous motion, satisfied the visitors that *Captain Fitzmaurice* had overcome the difficulties which eminent engineers have always considered it difficult to obviate in rotary engines, and they left, on their return to town, much gratified with the result of all they had witnessed, and pleased with the minute details he entered into, when showing the model, and explaining the principle on which the two pieces of which it consists work, the one within the other.—*Daily Journals.*

The experiments with Mr. James's cellular steam-generator were as follows :

The experiments gave an evaporation of 12¾ lbs. of water by the combustion of 1 lb. of coal—that obtained by the usual construction of boilers not exceeding 8 lbs., or an increase, by the application of the patent, of 60 per cent. of evaporative power. Besides the saving of fuel thus to be effected, there is the advantage that the flame scarcely impinges on the boiler, arising from the intervention of the cellular vessel ; and the boiler is accordingly saved from the rapid deterioration to which it is now exposed by the excessive heat which plays upon it. As applied to steam navigation, the effect of so reduced a consumption of coal in the working of large steam-vessels, must be obvious ; —the saving, in the shape of 50 to 60 per cent. in the article of fuel, being further increased by the extra space rendered available for the stowage of freight, or, on the other hand, the accelerated speed in steam propulsion, arising from a lightened burden of coal, are all advantages, the vital importance of which it is almost supererogatory to notice.

* * * *

The experiment was commenced 12 h. 47 m. P.M., when 56 lbs. of best engine coal, weighed with great nicety, was thrown into the furnace, the working temperature of the water in the boiler being 201° Fah. At 1 h. 59 m. P.M., or 1 h. 12 m. from the commencement of the experiment, the indications of the water-gauge were taken, from which it appeared that, in that period of time, the apparatus had vaporised 720 lbs. of water, equal to 12·86 lbs. of water converted into steam by 1 lb. of coal. The general size of the boiler, which is of the wagon form, without a flue, is 6 ft. 9 in. long, 3 ft. 6 in. wide, and 2 ft. 6 in. high ; the area of the bottom is about 21 superficial feet. The flue-surface is about 23 feet area. The area of the cellular plates exposed to the direct action of the fire is about 25 feet, and that of the plates within the boiler about 23 feet. The fire-bar surface is equal to 4 square feet. The quantity of water in the boiler was about 1500 lbs., and that contained in the cellular vessels about seven gallons. The quantity of water said to be evaporated by this boiler is about 12 cubic feet per hour, making it capable of raising steam sufficient for a 12-horse power engine, although its dimensions are only equal to that of an ordinary 4-horse power boiler.

It may be observed, as relates to the economy calculated upon by the application of the patent to steam navigation, to say nothing of the saving of space, that, taking a vessel of 400-horse power, such is found to consume about 27 tons of coal per day of 24 hours, which, with a saving of 60 per cent., assuming the passage to be 15 days, would give the following results :—Consumption of coal, say, 400 tons, saving 240 tons, which, if taken at 40s. per ton, including the cost of coals and allowance for space occupied, and which might otherwise be applied, would give a saving of 480*l.* We are aware that an estimate has been made, whereby our assumed saving is carried out more than threefold on a voyage of 45 days ; but we think the present statement amply sufficient to establish the saving which may be effected.

As applied to locomotive engines, it is to be supposed the patent will be equally applicable, although we are well aware that difficulties present themselves which do not apply to stationary engines, or those employed for steam navigation. The cost of coke per mile is, however, so formidable an item, that any saving which could be effected would necessarily lead to a considerable increase of profit and dividends to the shareholders. We do not deem it necessary further to enter on the varied applications, such as breweries, distilleries, and other establishments, where large quantities of liquid are required to be boiled, heated, or converted into steam, as the excess of power obtained is equally applicable, and a com-

parative saving consequently effected.—*Mining Journal.*

REPORT OF THE COMMISSIONER OF PATENTS OF THE UNITED STATES ON EXPLOSIONS OF STEAM-BOILERS, DECEMBER 30, 1848.

(Continued from page 262.)

That "*undue pressure within a boiler, gradually increased*," is one of the most frequent causes of explosions, has been proved, as well by recorded cases as by the experiments of the committee. One of the points of inquiry to which their attention was specially directed, was to ascertain the sort of bursting produced by a gradual increase of pressure; and after several decisive experiments, they came to the conclusion that all the circumstances attending the most violent explosions may occur without a *sudden* increase of pressure within a boiler.* This gradually increased pressure may result from the accidental failure of the apparatus intended to relieve it, or from this being intentionally prevented from operating by the reckless hands which sometimes have the control of it. Of the ninety-eight cases in which the causes of explosions are stated in the returns herewith submitted, sixteen (being 16⅓ per cent. of the whole), are assigned to this cause. The term "excessive pressure" in the Table indicates these cases.

The cases referred to "*the presence of unduly heated metal within the boiler*," are also sixteen. The danger attending the overheating of the boiler arises from the diminished tenacity of the metal thereby produced, which renders it incapable of any longer sustaining the ordinary working pressure; and from the metal's being made itself a reservoir of heat, capable of generating an increased quantity of highly elastic steam, as soon as water shall be brought in contact with it. This overheating of the boiler may be occasioned by suffering the water to become too low, or by allowing sediment to accumulate on the bottom. The former cause operates by exposing a portion of the surface next the fire to the action of heat while uncovered by water, and the latter by interposing a medium of but low conducting power between the fire and the water, thereby suffering the metal to acquire heat faster than that heat can be conveyed to the water. In either case the metal is technically said to be "burnt," and even if no serious consequences should occur at the time when such burning takes place, still the tenacity of the metal is thereby permanently diminished, its thickness decreased,* and the liability to explosion, therefore, greatly enhanced. In boilers where flues are employed, their collapse is the ordinary result of this state of things.

The deficiency of water may be the consequence of the pumps being obstructed, so as to throw in less than the requisite supply; or from their being heated, so as to inject steam; or from their not being in action when the engine is stopped and steam blowing off. The sudden removal of these causes of deficient supply, while the intensity of the fire continues at the same time undiminished, is very likely to produce an explosion for reasons already explained. Hence the greater number of these accidents which occur immediately upon starting the engine after a stopping at a landing, or for repairs. Mr. Evans expresses the opinion, that "eight out of ten explosions take place just at the time of starting from a landing, the engine making generally but one or two revolutions."†

The subject of deposits, in connexion with the overheating of the metal of the boiler, is one of great importance, and one which is still comparatively open as a field of research. The Franklin Committee made it one point of their inquiry to ascertain by experiment the effect of deposits in boilers. They admitted the collection and hardening of such deposits on the bottom of the boiler, and attributed the danger from them to the production of exfoliations of oxide, which gradually reduced the thickness of the metal, or to the weakening increase of temperature in the metal which they permit.‡

With regard to incrustations and deposites in the interior of steam boilers, it may in general be admitted that these must differ with the character of the water used. In boilers using "hard" water, they consist chiefly of the carbonates of lime and iron mixed with oxide of iron; containing, besides, the earthy salts from the water. Boilers using ocean water are found to detect the differences existing in different parts of the ocean in regard to the composition of its water. It appears that certain "scales" which were taken from the boilers of the United States steamer *Marcy*, and subjected to analysis by Professor Johnson, were found to collect in the boilers while running over the Bahama Banks; and the experience of the *Marcy* is confirmed by that of other steamers which have traversed the same

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* *Frank. Jour.*, vol. xvii., p. 325.

* The diminution of tenacity from overheating was found by the Sub-Committee on the Strength of Materials to be equal to about one-third of the original strength.

† Article in *Pittsburgh Chronicle*, before referred to.

‡ *Frank. Jour.*, vol. xvii., p. 323.

tract of the Atlantic. Professor Johnson's analysis showed this salt to be di-hydrated gypsum, and led him to the application of the acetate of potassa as a solvent.*

The introduction of oil or fat into a boiler may result in the production of another class of deposites entirely different from the scales above alluded to, and which appear to result from a combination of fatty materials with earthy bases. Such an incrustation was found in the interior of a steam boiler at Burlington, N. J., and was submitted to examination by Professor Johnson, who supposes it to be a species of soap, formed between the earthy oxides and the acids of animal fat.†

In streams which, like the Mississippi and its tributaries, flow for thousands of miles through an alluvial country, and which are subject to freshets, not unfrequently producing alterations in depth of from thirty to fifty feet, the quantity of earthy, calcareous, and other matters held in suspension is great, almost beyond conception. Mr. Cist gives the estimate of an intelligent engineer, that in a twelve days' trip on the Mississippi, the quantity of mud injected into the boilers was 51,600 gallons by measurement, or over 200 tons in weight. This calculation is based upon the supposition that the sediment in the water amounted to 10 per cent., a rate said to be below the fact, at least as regards the Mississippi.‡ This sediment collecting on the bottom of a boiler, becomes, owing to the admixture of calcareous matter with the mud of which it is chiefly composed, hardened by heat to such a degree that very often it can be removed only by the use of a chisel and mallet. Thus hardened, it is liable to crack from unequal expansion, or other cause, when it admits water to come in contact with the overheated and softened metal below. The necessity for constant attention to the condition of the boilers with reference to this matter is sufficiently obvious. The deposites from salt and chalybeate waters are not less dangerous.

The causes of unduly heated metal within a boiler usually operating, are no doubt those which have just been described; yet the Franklin Committee were induced, from the evidence before them, to admit the possibility of the metal of a boiler becoming unduly heated, even when in contact with water: the occurrence of such a fact, however, is extremely rare.

About one-third of the cases reported in the returns are attributed to "*defective construction of the boiler and its appendages.*" These defects may be reduced to three classes: 1. Defects in the form of the boiler; 2. The use of improper or defective material; 3. Bad workmanship. The first class is not noticed as a cause of explosion in the returns to this office. In the second are embraced fifteen cases; in the last, eight. In eleven others, the particular nature of the defect is not stated.*

That the influence of form upon the strength of a boiler must be very great, is obvious. The forms most commonly employed are, the wagon boiler of Watt, and the cylindrical boiler, either with or without flues. The boiler of Watt is only adapted to very low steam. Of cylindrical boilers, those without flues are most safe—those with flues have the advantage of economizing fuel. Those flues which pass through both heads of the boiler are considered the most safe. Boilers containing small tubes have not been found successful.

The connected boilers which are used on our western boats are incident to a peculiar source of danger; a mere change of position may be the cause of an explosion. The connecting water pipe is at the bottom of the boilers. When the boat careens, the water descends, of course, to the lower boiler, and leaves the higher ones exposed, in a greater or less degree, to the action of the fire while uncovered by water. The danger from such an exposure has already been pointed out. The use of connected boilers, in the opinion of the Franklin Committee, ought to be discontinued.

Boilers with L flues are liable to a similar source of danger. The portion of the flue above the level of the water in the boiler is exposed to the heat of the fire while not in contact with water. Its tenacity is thus diminished, and it is rendered likely to yield to the pressure within the boiler, and collapse

Boilers with steam chimneys are still employed for the sake of the advantage of having the steam surcharged with heat, so as to prevent condensation in the steam pipe and cylinder. They differ from those last mentioned only in the fact that the exposure is greater. The source of danger is the same. Two explosions of boilers of this kind, examined by Mr. Ewbank, were identical in the phenomena exhibited. The vertical arm of the L flue, in both cases, was collapsed in the same way, showing that the defect is inherent in the form. The Franklin Committee recommend the discontinuance of the use of both of these forms.

They also discourage the formation of small spaces to contain water and be sur-

* *Frank. Jour.*, vol. xliv., p. 226 (Oct., 1847.)
† Ibid, vol. xliv., p. 298.
‡ Cist's Com., Appendix [G] No. 1.

* Classification of causes at end of Table [C.]

rounded by fire. Such spaces are liable to accumulate deposites, and to become unduly heated by the water being forced out of them by the formation of steam, as in the case of small tubes.

Boilers of irregular forms are necessarily weak; the tendency of a force acting within them equally in all directions would be to bring them to a cylindrical or spherical form.*

The use of cast iron as a material for boilers is believed to have been entirely abandoned; but five cases are given in which this material was employed for the *heads* of boilers which exploded; and its use for boiler heads is still, to some extent, persevered in, notwithstanding the warning voice which science and experience have united to raise against it.† The question of the safety of the employment of this material for boilers came up before the Committee of the British Parliament, who were charged with the investigation of the causes of explosions in the year 1817; and the testimony against its use, even at that early period in the history of steam navigation, was unequivocal.‡ The use of boilers, or boiler tubes of cast iron, was positively prohibited by the French Government in 1828.‖ The operation of casting, however well performed, is an uncertain process; and the defects of structure incident to it being concealed from view, lead to a false impression of the real strength of the article cast. But, perhaps, a more pregnant source of danger in the case of cast-iron heads lies in the unequal rate of its expansion as compared with the wrought metal to which it is attached, rendering it constantly liable to fracture or cracking. Mr. Cist, in his valuable communication, mentions a case in which the cast-iron heads of a range of seven boilers were all found in pieces when the boilers were taken apart at the head, and remarks that these heads are generally found in this condition when they are removed from the boilers. The history of six boilers of this kind, which were made at Shippingport, affords a striking proof of the danger arising from the use of such heads. Of these boilers one was placed on the *Car of Commerce*, and, although the only new boiler on the boat, it was the only one that gave way. Its after head was blown out, and the boiler was projected several hundred feet over the bows of the boat into the river. The five others were put into the *Atlas*, and exploded the same season in a similar manner. The case of the *Helen McGregor* was of the same character. The head of that boat's boiler blew out and broke into numerous small fragments, killing several persons and wounding others.* Every consideration, then, of prudence, and even of common humanity, would seem to dictate the immediate and total abandonment of cast-iron as a material for boiler heads.

The question of the relative strength of materials with direct reference to their use for steam-boilers has been made the subject of a series of elaborate experiments by a sub-committee of the Franklin Institute, of which Professor Johnson was chairman, in whose able report the subject is considered in a light entirely new. In these inquiries the element of *temperature* in its relation to *tenacity* has, it is believed, been for the first time fully considered. The practical value of the results of this protracted and laborious research has been admitted by men of science throughout the world. It would be impossible here to give, within any reasonable limits, an abstract of these results; some of the general conclusions to be drawn from them will alone be stated.

The question of the relative merits of copper and iron as materials for steam-boilers is directly affected by the experiments of this committee. The advantages of the former material are its superior durability, and its high-conducting power, besides the value of the old materials; but, on the other hand, it is found that an increase of temperature is attended invariably with a diminution of strength, the squares of the diminution of strength varying as the cubes of the temperatures.† Between the freezing and boiling points it parts with 5 per cent. of its strength; at 550° Fahr., it loses about one-quarter; at 850°, one-half; and at 1300° it becomes a viscid, granular, soft, incohesive substance, entirely destitute of tenacity, though it does not absolutely melt under 2000°.

Iron, on the contrary, presents a state of fact directly the reverse, and apparently anomalous; it increases in tenacity with the increase of temperature until it reaches its maximum strength at about 570°, at which temperature it is 16 per cent. stronger than when cold.‡ When this temperature is exceeded, however, its strength rapidly diminishes. An explanation of this effect will be given hereafter. The different modes

* General Report, Franklin Committee, p. 34.
† Ibid., p. 37; also Appendix G, No. 1.
‡ Parliament Report, 1817, vol. iv., Galloway's, Collinge's testimony, *et. al.*
‖ See Circular to Prefects, August 1, 1828; *Frank. Jour.*, vol. viii., p. 33.

* *Franklin Journal*, vol. viii., p. 308.
† Rep. on Strength of Materials, p. 75.
‡ Ibid, p. 213.

of manufacture also were found materially to affect the tenacity of iron. Repeated piling and welding is attended with a great increase of strength.* Pig iron of a white fracture produced the most cohesive bars; lively, gray, dead gray, and mottled metal produce bars inferior to the first by from 1 to 5 per cent.; and a mixture of all the kinds gave the most unfavourable result, being from 5 to 10 per cent. below the first in tenacity.† The difference between the strength of boiler-plate cut lengthwise, and that cut across was found to be about 6 per cent. in favour of the longitudinal over the cross-cut.‡ Riveting diminished the strength about one-third.§ Long use and exposure were attended with great loss of strength.|| Overheating also produced a permanent reduction of tenacity about one-third.¶ The thinning of boiler-plates by pressure was also made a subject of careful inquiry. It was found to amount in iron to about 16½ per cent of the whole area, to take place less in heated than in cold specimens, and to be attended with great weakening of the plate.** Fractures at high temperatures took place suddenly, and the section was smooth, flat, and tapering.†† An important practical result of this investigation is, that boiler iron cannot safely be exposed to a pressure greater than *one-fifth* of its standard maximum cohesion; 12,500 lbs. of extension on each square inch of cohesive action may be assigned as the safe working strain of iron boilers.

A result which affords an explanation of the apparent anomaly with regard to the tenacity of iron before noticed, grew out of a minute investigation of the same subject by Professor Johnson. It is, that iron which has been subjected to a tensile force while heated to a temperature not exceeding 500° or 600° Fahr. (that force being equal to the whole tenacity of the metal *before heating*), will, when again cooled down to the ordinary temperature of the air, be found stronger, not only than it was before heating and straining, but also *stronger than it was while hot*.‡‡ This shows that the increase of tenacity is not due to the presence of heat, as it still remains after the metal is cooled, but probably to some molecular change in the iron which the increase of temperature allows the tension to produce. This principle has been made the foundation of inventions for the improvement of the manufacture of iron,* and of articles formed therefrom (such as chains, connecting-rods, &c.), and has relation to steam-boilers not less than other articles formed of iron, inasmuch as the strain put upon an iron boiler at a high temperature is proved not so to weaken it as to render it afterwards liable to rupture by a less force. The same experiments prove that when the temperatures above mentioned are much surpassed, iron begins rapidly to lose not only the acquired additional strength, but also that which it possesses in the cold state, as it came from the hammer or the rolls.

In another respect, the influence of heat upon iron, within the range of temperature above stated, is found to be important. In a report on this subject made to the bureau of construction, equipment, and repairs, of the navy department, under date of September 4, 1843,† the interesting fact is presented that a bar or bolt of iron of good quality, when strained lengthwise with such a force as to break it while cold, will, in general, be elongated before it actually breaks by about 16½ per cent. of its original length; but that the same iron when strained at a high temperature, not exceeding 400°, and with a force equal to that which broke it in the cold state, will only be elongated 5½ per cent., or about one-third as much as when the same force had been applied to it cold. This principle, applied to the steam-boiler, shows that there is no danger of reducing the thickness of the sheet of iron by such a force of steam as would place the boiler under the same strain as it would bear when cold.

It is believed that the republication of the whole investigation of the Committee of the Franklin Institute, and its wide dissemination among the practical engineers of our country, would be an important service to the cause of public safety.

When the material used for boilers is the best in its general kind, it may still be individually defective in quality. Mr. Cist expresses the opinion that much of the boiler iron of the west is made from inferior ore, deficient in fibre and tenacity. The case of the *Louis Whetzel* is mentioned as an illustration, in which the boilers gave way on the first trip, under ordinary pressure, and while containing a sufficient supply of water to preclude the idea of their being softened by heat. The repeated recommendation of a test, to be enforced by

* Rep. on Strength of Materials, p. 234.
† Ibid, p. 189
‡ Rep. on Strength of Materials, p. 224, 5.
§ Ibid, p. 228.
|| Ibid, p. 237.
¶ Ibid, p. 246.
** Ibid, p. 246.
†† Table XLVII., ibid, p. 125.
‡‡ *Amer. Journal Science* (new series), vol. i., p. 299.

* Professor W. R. Johnson's Patents of June and July, 1838.
† Doc. No. 2, 2nd session, 28th Cong., p. 639.

law of the quality of iron used for boilers, indicates the existence of a general conviction that the quality employed for this purpose is often dangerously inferior.* A number of instances are given in which the boilers or flues were deficient in thickness. Such were the cases of the *Clyde*, the *B. Gilman*, the *Persian*, *Oronoco*, *Superior*, *Missouri*, *Alton*, *Majestic*, and others; in all which cases there appears to have been no deficiency of water in the boilers. The steam-boat, *Cutter*, is cited as a remarkable instance of the danger arising from deficient thickness of iron. In this case the boat was careened to one side—a position always involving danger to the upper boiler from a deficiency of water; yet the lower flue, (which proved to be the thinnest,) although completely submerged, collapsed, while the thicker flues on the other side, though unduly heated, did not give way.†

Bad workmanship is, doubtless, a frequent source of accident, though from the nature of the case, full information on this point cannot readily be obtained. Most of the cases in which this cause is distinctly assigned, consist rather of omissions of important parts than of defective work. With reference to repairs, however, there is direct evidence to show that they are frequently done in great haste, and without a due regard to safety. One case is given in which an iron boiler was patched with copper rivets; and one in which repairs were made by unpractised apprentice boys, because good workmen could not be immediately obtained.

(*To be continued.*)

* See Appendix G., Coms. of Cist, Guthrie, Spencer, Dawson, Dunlop.

† Mr. Cist's communication.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 20TH OF SEPTEMBER, 1849.

ALEXANDER SWAN, of Kircaldy, in the county of Fife, manufacturer. *For improvements in heating apparatus and in applying hot and warm air to manufacturing and other purposes where the same are required.* Patent dated March 14, 1849.

Mr. Swan describes and claims—*First*, a steam boiler in so far as regards the manner in which straight, or rectangular cylinders, or tubes, are therein combined with curved tubes, or flues, carried spirally around the others, for the purpose of generating steam.

Second.—An apparatus for the destructive distillation of coal, peat, and other like substances, in so far as regards the similar combination therein, of straight or rectangular cylinders or tubes, with curved tubes or flues, carried spirally around the others, and the application of such combination to the distillation of coal, peat, and other like substances.

Third.—An apparatus for evaporating lees in so far as regards the application to such purpose of a combination of straight or rectangular cylinders, or tubes, with curved tubes or flues, carried spirally round the others, and also a peculiar method of separating the steam from the lees.

And, *Fourth*,—Various methods of applying the peculiar combination aforesaid of straight or rectangular tubes, cylinders, or coils of tubing, with curved tubes or flues, carried spirally round them, to heating, drying and dessicating purposes.

We shall give in an early Number the description of the apparatus referred to in the third of these claims.

ANDREW SHANKS, of Robert-street, Adelphi, Middlesex, engineer. *For an improved mode of giving form to certain metals when in a fluid or molten state.* Patent dated March 14, 1849.

The improved mode which form the subject matter of this patent consists in casting pipes, cylinders, and spherical vessels without using cores during the process of casting. For this purpose a metal mould of the pipe or cylinder is put upon a machine consisting of several drums or pulleys, upon which the mould rests. When the molten metal is to be poured into the mould the drums are set in motion by some moving power, which causes the mould to revolve steadily upon its axis; the molten metal is thus made to adhere by centrifugal force to the sides of the mould, which is kept in a state of motion till the metal becomes cold or set. When the hollow vessel is of a spherical form, the mould is set upon the top of an upright spindle, which is kept revolving while the metal is being poured in, and until it sets as in the former case.

Claim.—The mode of forming pipes and cylinders by means of centrifugal force and without the aid of cores.

THOMAS CLARKE, of Hackney, Middlesex, engineer, and THOMAS MOTLEY, of Bristol, C.E. *For certain improvements in obtaining and applying motive power, also improvements in railroads and other roads, and in supporting pressure, resisting strain, and protecting against fire.* Patent dated March 14, 1849.

The patentees describe:

1. A tubular boiler in which the tubes are of a much smaller bore than usual, and a fan is employed to cause the water to circulate through the tubes.

Claim.—The application of a fan to cause the circulation of the water and the separation of the steam.

2. A carriage and locomotive combined—the novelty of which appears to consist solely in the combination.

Claim.—The locomotive and carriage, as described.

3. A pile-driving engine of peculiar construction. A rope or chain is attached to the head of the pile—then passed over a pulley, fixed to the top of a piston rod of a steam, water, or air cylinder—after which it is carried up over a pulley affixed to the upright shears of the frame, and attached to the ram. By this arrangement the lift of the ram from the pile at each stroke of the engine continues uniform. The same kind of motion and machinery may, it is stated, be employed for boring holes in stone, by substituting the boring tool for the ram.

Claim.—The arrangements of the pile-driving engine, as described.

4. An improved steam excavating machine, in which the motion of the shovelling and lifting tool is produced by a crank and levers, so that it describes nearly an elliptical path.

Claim.—The excavating machine, with the "circular motion" given to the excavator.

And, 5. Several other improvements relating to the construction of roofs, beams, girders and bridges, to the formation of carriage-ways by lines of wooden blocks, and to the rendering of floorings fire-proof.

Robert Ross Rowan Moore, of the Temple, barrister-at-law. *For improvements in the manufacture of letters and figures to be applied to shop fronts and other surfaces.* Patent dated March 14, 1848.

The first of these "improvements" consists in forming letters and figures of gutta percha, or gutta percha along with other substances, and either plain or coloured.

A second improvement consists in forming the letters and figures in outline merely, and affixing them to bases of wood, glass, or gutta percha.

Claims.—1. The manufacture of letters and figures by moulding them of gutta percha.

2. The making of ornamented letters and figures in outline, as represented.

William Payne, of 163, New Bond-street, watch-maker. *For improvements in clocks and watches.* Patent dated March 14, 1849. See L., p. 399.

Francis Hay Thomson, doctor of medicine, of Hope-street, Glasgow. *For an improvement or improvements in smelting copper and other ores.* Patent dated March 14, 1849.

The patentee has disclaimed the words "and other," and confined his patent to the smelting of copper ores alone. The improvement therein consists in the application of whinstone iron slag, or other similar matters consisting chiefly of silex, as a flux to be employed in the reduction of the ores, whether in the form of sulphurets, carbonates, or oxides. A good flux is stated to be obtained by using with one ton of the calcined copper ore four hundred weight of broken whinstone and seventy pounds of pounded coke; if barilla be added, a smaller quantity of the whinstone will suffice.

Claim.—The employment of whinstone or iron slag, as a flux for copper ores.

George Ferguson Wilson, of Belmont, Vauxhall, gentleman. *For improvements in the manufacture of candles and night-lights.* Patent dated March 14, 1849.

These improvements relate to the purification of vegetable tallow and paraphine and to their employment in the manufacture of candles with double wicks.

The vegetable tallow or paraphine is first put into a vessel with about eight per cent. of sulphuric acid, 1·8 sp. gr.; it is afterwards distilled; but in order that it may be kept from coming in contact with the atmospheric air, the distillation is effected by the introduction of steam in numerous jets at the bottom of the vessel.

No claims.

William Gratrix, of Salford, bleacher and dyer. *For certain improvements in the method or process of drying and finishing woven and other fabrics, and in the machinery or apparatus for performing the same; part of which improvements are applicable to stretching woven fabrics.* Patent dated March 14, 1849.

For a full account of this specification, see *ante*, p. 266.

Pierre Augustin Chauffourier, of Regent's-quadrant, merchant. *For certain improvements in the manufacture of watches.* Patent dated March 14, 1849.

1. The main-spring of the watch is to be carried around the periphery of the case, so that it may be much larger in diameter and more capable of sustaining a strong pressure than usual—an arrangement more especially applicable to watches which are required to go a long time without winding up.

2. The wheels and other works of the watch are placed in a separate plane from the spring.

3. The main-spring is connected to the moving parts by a central boss of a peculiar construction.

Claim.—Each of the above improvements, as described.

JOHN SMITH, of Hare Craig, Dundee, factor to Lord Douglas, of Douglas. *For improvements in the manufacture of flour applicable to making of bread, biscuits, and pastry.* Patent dated March 14, 1849.

The object of this invention is to effect the reduction of oatmeal to the state of flour by means of a dressing machine, similar to that employed in the manufacture of wheat flour. The meal is fed into the dressing-cylinder through an upright cylinder or hopper, fitted with a set of revolving arms, which greatly facilitate the dressing. The velocity necessary to be given to the dressing machine is stated to be considerably greater than that required for wheat flour.

Claim.—The dressing of flour made of oats by the machine described.

PIERRE A. FONTAINEMOREAU, of South-street, Finsbury, London. *For certain improvements in coating or covering metallic and non-metallic bodies.* (Communication.) Patent dated March 14, 1849.

The patentee specifies a great number of new solutions of metals, which may be employed in coating other metals by the aid of the galvanic battery. We select some of the more remarkable :—

For Gilding.—Take 1 part chloride of gold, and precipitate with a soap made of gayac pitch; then dissolve the precipitate in 100 parts of hot water, into which there has been put 10 parts of caustic potash, or its equivalent of caustic soda.

Another for Gilding.—Take 1 part oxide or chloride of gold; dissolve in 200 parts of hot water with 20 parts of caustic potash, or its equivalent of caustic potash, to which add 15 parts of sulphate of potash or soda, for the purpose of rendering the fluid more capable of conducting the galvanic current.

For Platinizing.—Use a solution of bichromate of platinum and potassium.

For Silvering.—Use a solution of the carbonate of silver and the carbonate of ammonia.

ALLEN BRAGG, of Queen's-row, Pentonville, bath-keeper. *For improvements in propelling by atmospheric pressure.* Patent dated March 14, 1849.

The object of these improvements is the same which has occupied the attention of so many inventors, viz., to get rid of the slit in the atmospheric main. The arrangements adopted for this purpose by the patentee consist in having sets of cylinders laid between the rails, and parallel thereto, each cylinder being fitted with a piston, the rod of which passes through stuffing-boxes in the ends of the cylinder, and is connected outside to a longitudinal bar, notched or toothed upon its upper edge. The cylinders placed between the rails are connected by short pipes to the main exhaust pipe, which is laid outside of the rails. The propelling carriage, in coming over the positions of the respective cylinders, becomes partially connected to the notched bars by means of a paul which falls into one or other of the notches; and the movement of the piston is effected at the same instant (by the communication being opened up between the cylinder and the air exhaust-pipe), which causes the carriage to be propelled so much in advance, by which it comes in contact with the notched bar connected with the next cylinder, where it receives another push forward, and so on continuously, until the pauls are lifted up from coming in contact with the notched bar.

Claim.—The above mode of propelling by atmospheric pressure, and especially the notched bar attached to the piston rods.

JAMES WILLIAMSON BROOKE, of Camden Town, gentleman. *For improvements in lamps.* Patent dated March 14, 1849.

These improvements have special reference to spirit lamps. The spirit is contained in a glass reservoir, from which it is conveyed, by capilliary attraction, through a cotton wick into an upright metal tube, where it is vaporised by the heat of the burner, and from which the gas or vapor generated is conveyed through two small holes into another tube, where it gets mixed with atmospheric air admitted by a hole in the side of that tube (the top of which forms the burner). The mixed gases, or air and vapour, escape through holes pierced in the burner where it is ignited.

Two other varieties of burners are shown in the drawing as being applicable to the same sort of lamps. In one of these, the slit across the burner is at top, so that the flame is of a flat form; in the other, a flat flame is produced by the gas being allowed to escape from a hole directed at an angle to a plane surface or plate of metal.

Claims.—1. The lamp, as described.

2. The two varieties of burners, as described.

JOSEPH BERANGER, of the firm of Beranger and Co., of Lyons, C.E. *For improvements in weighing-machines.* Patent dated March 19, 1849.

These improvements are exemplified by numerous drawings, without which it would be difficult to describe them in detail. We can but say that they have reference; first, to weighing-machines constructed on the steel-

yard principle; second, to counter and warehouse scales and beams; and, third, to weighing machines for ascertaining the weight of locomotive engines and carriages. A peculiar feature of this last class of weighing-machines is, that each time a locomotive or carriage comes upon the machine to be weighed, its weight is registered by an apparatus, formed of a revolving cylinder covered with paper, and a pricker which marks upon the paper the weight put on the machine. The cylinder and pricker are moved by putting on and taking off the weight upon the machine.

Thomas Henry Russell, of Wednesbury, patent tube-manufacturer; and John Stephen Woolrich, of Birmingham, chemist. *For improvements in coating iron and certain other metals, and alloys of metals.* Patent dated March 19, 1849.

These improvements consist firstly, in coating iron by the metal cadmium, either with the aid of electricity, galvanism, or the magneto-electric machine, or by immersion in a hot bath of the metal.

When the coating is to be effected by means of the galvanic trough, a precipitate of cadmium is first formed, which is then dissolved in a solution of the cyanate of potassa. The articles to be coated are immersed in the solution and treated in the usual manner now practised in coating metals by the aid of the galvanic battery. The positive wire should terminate in a plate of cadmium, and that should surround or be placed at a few inches from the surfaces to be coated.

When the articles are to be coated by immersion in the molten metal then a portion of tin is to be added to the cadmium. The articles are cleaned by dipping in dilute acid, and then plunged into the melted metal; being kept in which for some time, the surfaces will become coated. The surface of the melted metal is kept covered with oil or tallow, to prevent the action of the oxygen of the atmosphere upon it.

Articles made of iron may be protected by being partially covered with cadmium, such as screw-propellers, &c.

The patentees describes, secondly, certain methods of coating metals with copper by the aid of the soluble acetates, benzoates, and cyanites of potassa.

Claims.—1. The coating of metals or alloys of metals with cadmium, or alloys of cadmium, and the partially covering of articles to be protected with cadmium.

2. The coating of metals with copper or alloys of copper, by means of the soluble acetates, benzoates, and cyanates of potassa.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman. *For improvements in the manufacture of piled fabrics.* (Communication.) Patent dated March 19, 1849.

The patentee describes and claims—

1. Certain improved arrangements for bringing forward the wires to the lay, in looms for weaving piled fabrics—inserting them into the shed—bringing them up against the warp—withdrawing them from the pile after the same has been formed—and bringing them again into a position to be again re-employed in the same way.

2. The employment of guides for the wires, and which move along with the wires when these pass through them.

3. The employment of two wires, so that these may be introduced one from each side of the loom, and thus abut or overlap each other at the centre of the loom.

4. Certain arrangements for beating up the wires against the lay, without causing a corresponding movement of the harness or shuttle. And,

5. The employment of wires with the ends sharpened, so that when they are withdrawn from the pile, the loop may be cut by them.

William Harrison Pickering, of Liverpool, merchant. *For improvements in evaporating brine and certain other fluids.* (Communication.) Patent dated March 19, 1849.

The patentee proposes to employ for evaporating brine two large shallow vessels connected together; the one is about twice the depth of the other; the deepest vessel or pan contains coils of steam pipes laid horizontally, with their upper side above the surface of the fluid to be evaporated, and leaving a space below them, from which the deposited salt may be easily taken. The two vessels, when connected together, are provided with sluices—one near the bottom, and the other near the surface of the fluid. The cold brine flows into the steam-heated vessel at the lower sluice, and the heated brine flows out to the other vessel by the upper one.

Claims.—1. The sluices employed in pans for evaporating salts, to allow of a free circulation of the fluid through the pans.

2. The having the one vessel containing the steam pipes deeper than the other vessel, and connecting them together by an inclined plane.

Alexander McDougall, of Longsight, Lancaster, chemist. *For improvements in recovering useful products from the water used in washing and in treating wool, woollen cotton, and cotton fabrics and other fabrics.* Patent dated March 19, 1849.

The specification of this patent describes those improvements only which relate to

recovering "useful products from the water used in washing." These consist in forming a precipitate of the soap in the water by means of the muriate of lime (or chloride of calcium), from which the water is extracted, after which it is treated with muriatic acid in the same way as animal fatty acids are treated by candle-makers. A resulting product of this treatment is the muriate of lime, which can be again employed for the same purpose.

Claim.—The means described for recovering useful products from water employed in washing.

SAMUEL HALL, of King's Arms-yard, Coleman-street, London, C. E. *For improvements in apparatus for effecting the combustion of fuel and consuming smoke, and for preventing explosions of steam boilers, and other accidents to which they are liable.* Patent dated March 19, 1849.

In this new apparatus, or furnace, of Mr. Hall, the bars are inclined from the horizontal line toward the back of the furnace; they are acted upon by revolving eccentrics, to which they are attached so as to have an alternating motion from front to back of the furnace: at front the top of the furnace is covered with a boiler protector (a water heater); at the further end of the furnace there is a trap-door formed of fire-brick, upon which the scoria from off the bars collects, and which is acted upon by a hand lever, so that the unburnt materials upon it may fall into the ash-pit.

The steam boiler is provided with a pipe leading from the safety-valve to the furnace, so that in the event of steam blowing off at the valve, it is conveyed into the furnace, and damps the fire.

The specification next describes a feeding apparatus for supplying water to the boiler, which consists of a chamber which is alternately filled and emptied into the boiler by means of two cocks, the one leading from a supply pipe into the chamber, the other leading from the chamber into the cistern. The cocks are opened and closed by means of wheel gear attached to them; the speed of the wheels is regulated by the float, which is made to act upon a band running over two cones, which causes the wheels to turn quicker or slower, according to its position on the cones.

The last improvement described consists in having wheel gearing attached to the fety-valve, which causes it to keep constantly turning round on its seat, and thereby prevents the risk of its becoming locked.

GEORGE KNOX, of Moorgate-street, London, secretary to the Shrewsbury and Birmingham Railway Company. *For improvements in railway carriages.* Patent dated March 19, 1848.

1. Mr. Knox's improvements consist, first, in the construction of a buffer-truck or carriage, which consists of three distinct pieces or carriage bodies, placed some distance apart from each other, and affixed to a frame, the side rails of which are capable of being slid the one over the other, like a telescope tube. Buffers, composed of rings of vulcanised India rubber and metal plates placed upon a sliding-rod, are interposed between the pieces of the carriage; breaks are placed between the wheels on each side, and are connected by springs, so that when the frame of the carriage shortens, the breaks begin to act upon the wheels.

2. A buffer is last described, composed of flat springs, attached to a malleable iron cylinder, which slides within another box or chamber; also a modification of this buffer composed of malleable iron cylinders, with helicals prings placed inside.

3. A draw-bar and hook, with a helical spring superimposed between the head of the draw-bar and the carriage.

4. Mr. Knox claims, lastly, making the internal surface of the naves of railway carriage wheels to terminate in a bell-shape, by which the risk of breakage to the axle at that part is lessened.

5. A ventilator for railway carriages, which is composed of two slotted plates,—the one slides over the surface of the other, so that the openings may be made greater or less at pleasure.

6. An improved coupling-screw for railway carriages. There are three arms to the screw, and these are made of sufficient length to enable the screw to be turned without going between the carriages.

7. A mode of connecting the different parts of the framing of railway wagons together without mortices. The jointings are effected by means of metal plates and sockets.

Claims.—1. The buffing carriage, as described.

2. The improved buffers.

3. The elastic draw-bar.

4. The making the interior of the naves of railway wheels of a bell-shape.

5. The ventilator for railway carriages.

6. The improved coupling-screw. And

7. The mode of joining the frames of railway trucks without mortices.

WILLIAM PARKINSON, of Cottage-lane, City-road, Middlesex, gas-meter manufacturer, successor to the late Samuel Crosley. *For improvements in gas and water meters, and in instruments for regulating the flow of fluids.* Patent dated March 20, 1849.

Mr. Parkinson describes and claims—

1. An improvement in (wet) gas-meters, which consists in placing the aperture through which the water is supplied to the meter at an elevation above the proper level of the water therein, and the mouth of the overflow pipe at or about the centre of the area of the water in the meter.

2. An improved adaptation of the drum or wheel of the ordinary gas-meter to the measuring and registering of quantities of water. We shall give a full description of this, with engravings, in our next. And,

3. An improved ball-cock, which differs from that of Lambert in this, chiefly—that the plug, instead of acting against a flexible diaphragm, takes into a recess made for it in the back part of the cock.

CHARLES WILLIAM SIEMENS, of Birmingham, engineer. *For certain improvements in engines to be worked by steam and other fluids, and in evaporating liquids.* Patent dated March 20, 1849.

The first of these improvements is in a method of allowing the greater portion of the exhaust steam to escape into the atmosphere by an escape-valve; the remainder is employed to heat the water of condensation for feeding the boiler; the invention being in these respects similar in principle to Urwin's engine, described in the *Mech. Mag.*, Nos. 1353, 1354, 1356.

A second improvement is in a condenser, which formed the subject of a former patent of the patentee.

The chief claims in respect of both improvements have reference to the means employed for reducing the quantity of water required for condensation, and the recovering of the heat carried off by the waste steam.

A third improvement relates to the construction of evaporating pans; the object aimed at is the recovery and re-employment of the heat of the steam used for producing the evaporation.

Claim.—The evaporating apparatus described.

Specification Due, but not Enrolled.

IGNACIO DE BARROS, of Lisbon, Portugal, but now of Paris, gentleman. *For improvements in machinery for making lasts for boots and shoes, butts or stocks for fire-arms, and other irregular forms.* Patent dated March 14, 1849.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles Marsden, of Kingsland-road, for improvements in traps to be applied to closets, drains, sewers, and cesspools. September 20; six months.

William Edward Newton, of Chancery-lane, civil engineer, for certain improvements in pumps, and in machinery or apparatus for working the same, which latter improvements are also applicable for working other machinery. (Being a communication.) September 20; six months.

William Handley, of Chiswell-street, Finsbury, confectioner; George Duncan, of Battersea, engineer; and Alexander McGlashan, of Long Acre, engineer, for improvements in the construction of railway breaks. September 20; six months.

Henry Bessemer, of Baxter House, Old St. Pancras-road, engineer, for improvements in the preparation of fuel, and in apparatus for supplying the same to furnaces. September 20; six months.

Elijah Galloway, of Southampton-buildings, Chancery-lane, engineer, for improvements in furnaces. September 20; six months.

Joseph Rocke Cooper, of Birmingham, gun and pistol maker, for improvements in fire-arms. September 20; six months.

Edward Staite, of Lombard-street, gentleman, and William Petrie, of King-street, gentleman, for improvements in electric and galvanic instruments and apparatus, and in their application to lighting and to motive purposes. September 20; six months.

William Peace, of Haigh, near Wigan, Lancaster, and Edward Evans, of Wigan, engineers, for improvements in steam engines and in pumps. September 20; six months.

Josiah Lorkin, of Ivy-lane, merchant, for an improved instrument or apparatus for beating or triturating viscous or gelatinous substances. September 20; six months.

Benjamin Wren, of Yarm, York, miller, for an improvement in cleansing and treating certain descriptions of wheat. September 20; six months.

David Owen Edwards, of Sydney-place, Brompton, surgeon, for improvements in the application of gas for producing and radiating heat. September 20; six months.

John Baptiste Vuldy, of Mile-end, dyer, for improvements in giving a gloss to dyed silk in skeins or hanks. September 20; six months.

Thomas Griffiths, of Islington-row, Birmingham, for improvements in the manufacture of tea and other pots and vessels, and other articles made of stamped metal. September 20; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Sept. 15	2030	William and Charles Eley	Old Bond-street	Cartridge-case.
17	2031	Frederick Gotto	Dover, Surveyor	Self-discharging effluvia trap.
18	2032	Charles Chapman Clark	Reading	Self-acting water-closet.
,,	2033	Isaac Benjamin	Old Change	Acme brace front.
19	2034	Joseph Bell, of the firm of Cort and Bell	Leicester	Effluvia trap.
,,	2035	C. Gore	3, New Charles-street, City-road	Gas exhauster.
,,	2036	Foster, Porter, and Co.	Wood-street, Cheapside	Spring Muffler.
,,	2037	Charles Maschivitz	Birmingham	Letter Stamp.

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

PARKINSON'S PATENT GAS AND WATER METERS.

Fig. 2.

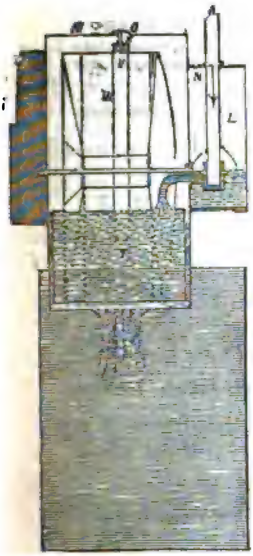
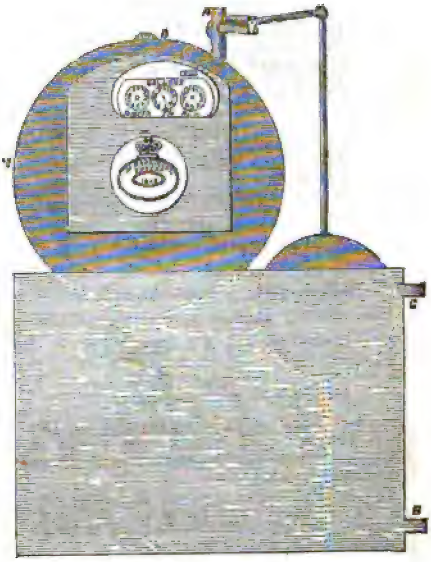


Fig. 5.

Fig. 1.



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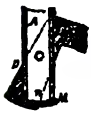

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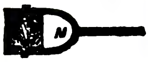


Fig. 4.

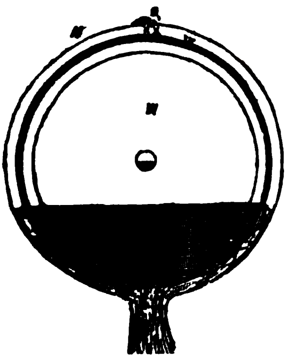
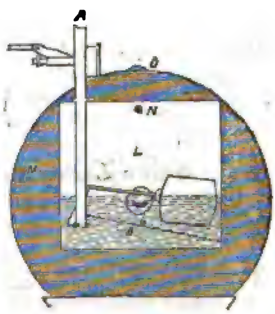


Fig. 7.

Fig. 8.

Fig. 3.



PARKINSON'S PATENT GAS AND WATER METERS.

(Patent dated March 20, 1849. Patentee, William Parkinson, of Cottage-lane, City-road, Gas Meter Manufacturer, successor to the late Samuel Crosley. Specification enrolled March 20, 1849.)

I. Mr. Parkinson's improvements in gas meters consist, *firstly*, in supplying the meter with water through a chamber shut off from the rest of the instrument, the mouth of which chamber is placed at an elevation *above* the proper or measuring level of the water inside; and *secondly*, in placing the mouth of the overflow or waste-pipe at or about the centre of the area of the water. By these arrangements, the following valuable results are obtained:—No more than the proper quantity of water can be introduced into the meter under any circumstances, because, as soon as there is the least escape, it flows over into, and is discharged by, the waste-pipe—the mouth of which being placed in the centre of the area of the water, is beyond the reach of being tampered with from the outside. Neither, can any water be abstracted by a syphon or otherwise, from the interior of the meter through the supply aperture (the course usually adopted by fraudulent consumers), because there is no communication between the water of the supply chamber and the water in the inside of the meter. As little can any gas be stealthily abstracted through the water supply-pipe (another of the devices of dishonest meddlers), because, the only gas which can be reached at through that aperture, must be gas which has passed through the drum, and been already registered against the consumer. Again; should the meter happen not to be set on a perfect level, or the level become changed by a depression of the bearings from time or accident, the level of the water will, in consequence of the central position of the mouth of the waste-pipe, be obviously much less affected than where the mouth is, as usual, close to the side. And thus, while the proper measuring water-line of the meter can always be readily adjusted to afford any needful protection to the consumer, the gas-supplying companies may place the fullest confidence in the perfect correctness (within commercial limits) of the quantities registered.

II. Mr. Parkinson's water meter, is an improved adaptation of the wheel or drum used in the ordinary gas meter, to the purpose of measuring and registering the quantity of water drawn from or delivered by any source of supply. Mr. Parkinson read a paper on this water meter, at the recent meeting at Birmingham of the British Association; and we cannot do better than introduce the substance of that paper here:—

An equitable mode of dispensing any article of consumption must be recognized by both dispenser and consumer as the proper principle to be adopted.

Originally, gas was sold by time or scale, and the burners adjusted to certain rates of consumption; it was, however, apparent to Mr. Crosley (one of the original patentees of the gas meter), that an instrument to accurately measure the gas must supersede such a vague and uncertain mode; and this it was which induced him to persevere so long to perfect that instrument, although many gas companies strenuously opposed its introduction and denied its utility; but time has proved the correctness of his views, and the gas meter is now considered (even by those very companies) an indispensable instrument in the distribution of gas. The same arguments apply to the dispensation of water; for the rating of houses is as unequal, vague, and ambiguous as the estimation of gas by scale and burner. A meter, therefore, appears as desirable to measure the one as the other.

The patentee is aware that many persons have attempted to accomplish this object. Amongst the number was his talented predecessor, the late Mr. Samuel Crosley, who took out a patent for this purpose many years ago, but, for various reasons, he never fully carried it out. The patentee has founded his meter on a similar principle, with various improvements in combination, and formed a machine which he believes to be at once simple in construction, accurate in measurement, and adapted for general use under any pressure; not that the pressure is admitted into the body of the machine (for that would require one of enormous strength and of great cost), but the pressure is brought up to the machine in a pipe, and reduced on entering the meter to a proper level to be measured, and takes an accurate registry of the quantity passing through the meter, whether supplied under a pressure of several hundred feet or by drops.

The general adoption of such a machine will, no doubt, find many advocates and opponents. The patentee, however, trusts

that the arguments used in favour of gas meters will equally prevail in the general introduction of water meters—the use of both being based upon the same principle of equity and fairness.

A free and uninterrupted supply of water from the main is necessary, however, to carry out this system. Many companies already afford such supply; and its advantages over periodical supplies are universally admitted, could a means be found to secure at the same time a fair remuneration to the companies.

For general purposes the present water meter is found best adapted for use, by being placed upon a small cistern containing three or four gallons, in which a float is placed to work the supply-tap, by turning the water on and off—making it, in fact, a self-acting machine. The water is drawn off from a pipe fixed near the bottom of the cistern, instead of direct from the meter, for it is found that a rate of 50 or even 100 gallons per hour is a tiresome rate in filling a pitcher or pail. A cistern holding about four gallons is found to remedy this tediousness. An advantage is found also in a self-acting ball-tap, in preventing any concussion from the stoppage of water on suddenly turning a tap under very high pressure. The advantages of this system and arrangement may therefore be stated as follows:—

1. An uninterrupted and instantaneous supply.
2. Equity between buyer and seller.
3. All annoyance from frost and occasionally short supply is avoided, as the pipes may be laid internally.
4. In new buildings the meter will be found cheaper than the old cistern.
5. Durability of meter, which may be fairly reckoned to last 25 or 30 years; and when properly fixed in an elevated situation, free from damp, dust, and injury, (such situations being easily found in an upper closet, landing, or bracket, placed for this purpose, *where* the index can be easily seen).

In giving a description of this water meter, it may be stated that the wheel or drum, which is the measurer, is similar to the drum used in the gas meter; it is divided into four compartments, each compartment with its inlet and outlet occupying nearly one-half of its circumference; consequently they overlap each other at both ends, so that before one compartment is filled another has commenced filling, and continues to receive the regular flow of the water, thus causing the revolution of the drum, as in the gas meter. One end of the drum is covered by a disc with a hole in the centre; this disc, or hollow cover, serves as a perpetual funnel to receive the water to be measured; all the four inlets of the compartments are open to it; the height of the water within this funnel, as well as in the lower compartments, depends upon the height of the water in which it is intended to revolve; this is defined by a trough a little longer and wider than the segment of the wheel which its height defines, say, in a 50 gallon meter, about 2 inches below the centre. When the wheel or drum is not at work, the trough remains full of water, and the wheel and funnel up to the same level; when the water is let into the funnel or hollow case, it immediately enters the compartment, or those compartments, the openings into which are under water, and by endeavouring to fill those compartments turns the drum round, and the quantity measured by each compartment is defined or determined on its inlet rising out of the water. The water remains in each compartment, until the drum has revolved so far as to bring its outlet passage to the level of the trough, through which outlet the compartment is emptied, running over the edge of the trough into the cistern below. It will therefore be seen that a considerable scope is given in the compartments to be more or less filled, without at all interfering with the principle on which the drum is constructed. It is the trough which defines the measurement, which, in adjusting the meter, is raised or lowered by the screw at the top; the wheel or drum revolves upon an axis in a similar way to a grindstone. The head of water necessary to make the drum revolve when at full work, never exceeds one or two-tenths of an inch elevation; that is, the head of water in the revolving funnel is never more than about one-tenth of an inch higher than in the trough. It is only the friction on the axis which can retard it, as the various compartments do not run through the water, but only travel *with it*.

On one end of the axis of the meter is an endless worm, similar to those in gas meters, which communicates motion to the index, and registers, the quantity passing through the meter; the index is the compartment at the front of the meter. The compartment at the back contains a small float attached to a regulator for letting in the water under high pressure. The use of this instrument is similar to that of a ball tap; but it is essential that it should work with very little friction, and that the water which always enters under greater or less pressure, should have no effect in either opening or shutting it. There are various ways of accomplishing this, one of which may be explained by stating that it is a contrivance similar to the throttle valve in the steam engine. The valves used in the water meter are slides

passing over oblong orifices, which slides hang upon centres, and the surface of each slide is struck from a radius of about 1 inch, forming a sort of sector. The lever and float are about 6 inches in length, the pressure having a tendency to force the slide from its face, so as to avoid friction. It is not necessary that it should be absolutely water-tight. Another plan which may be used, consists of a common clack valve opening downwards, the force to open which is counteracted by a piston of equal area fastened to the shank of the valve. This is a modification of Mr. T. Lambert's ball-tap valve; and from its soundness and absence from friction, is preferable to any other in use. There is in this compartment also an arrangement to prevent the rush of water agitating the surface of the water upon which the float rests. This is accomplished by directing the current to the opposite side into a sort of horizontal square funnel, which strikes the further end and returns back again, then flows slowly above it to the spout without even ruffling the surface. The quick current by this means meets the slow returning one, assisting in retarding its motion, in addition to the regularly enlarged opening of the funnel.

We abstract the following additional details from Mr. Parkinson's specification:—

Figure 1 represents a meter of this description attached to the top of a water cistern, and capable of registering a flow of 90 gallons per hour. Fig. 2 is a section of the same, through the centre from front to back. Fig. 3 is a section through the box, L; and fig. 4 a section through the centre of the meter at right angles with fig. 2. The wheel or drum, W, is inclosed in a case, M, as in the gas meter, but it revolves at bottom in a trough of water, T, which is freely suspended from the top of the case, M, by a semicircular handle, V, and adjusting-screw, X. The height of water in the trough determines, of course, the measuring capacity of the compartments of the drum; but that height may be varied as may be required, by raising or lowering the trough by means of the adjusting-screw, X. The water passes from the trough into the case, and thence into the cistern beneath; and it must never be allowed to rise in the case above the edge of the trough. The apparatus for regulating the inflow of the water into the trough is inclosed in a separate box, L, similar to the box which contains the inlet valve in the gas meter. A view of this apparatus, in two different positions, is given separately in figs. 5, 6, and 6^a. A is a vertical pipe, which is connected at top by a pipe, hose, or otherwise with a head of water, and terminates at bottom in a segmental flange, M, in which there is a diagonal slit or opening, *n*, for each passage of the water. To the outer sides of this pipe, A, there is gimballed a moveable valve, D, the top surface of the bottom part, *d*, of which is turned truly to correspond with the under face of the flange, M. As long as this valve is in the same vertical plane with the pipe, A, it completely closes the opening, *n*, but on being drawn to one side, as represented in fig. 6, it passes more or less from under the diagonal opening, *n*, and allows a proportional outflow of water. It will be obvious, therefore, that by attaching a float to this gimballed valve, as shown in fig. 3, there will be always just as much water supplied as may be wanted. The instrument is in effect very similar to a ball-cock, only that it is much better adapted for accomplishing the end in view, because it is attended with extremely little friction, and the water, however great the head pressure may be, has no tendency either to open or shut it; the only thing affecting it being the actual rise or fall of the float. To obtain a smooth surface for the float to work in, a shield, A^a, is inserted athwart the box L, in a direction inclined downwards from a point, immediately above the bottom opening *n*, of the pipe A. The force of the water, whatever may be the velocity with which it enters, is broken against the bottom of the shield A^a, so as to leave the upper surface of the water in the case L, perfectly undisturbed. Instead of the regulating apparatus just described, another may be adopted, such as is represented in figs. 7 and 8, which will answer equally well. A, is an inlet pipe, as before, which is soldered (sidewise) to, and communicates at bottom with another pipe, D. E is a conical valve fitted to the bottom of the pipe D, the spindle of which is connected at top to a small piston of equal area with the valve, by which piston any tendency which the pressure of the water might have to open or shut the valve is completely counteracted or neutralized. N O are apertures to admit a free ingress or egress of air from the box, L, and case, M. It may be proper to observe, that though the water in the trough will be raised higher when the meter is passing a large quantity of water than when passing a small quantity, yet that the difference in registering at a moderate velocity is so small as to be hardly worth taking into account (say, for example, in passing 100 gallons per hour with a wheel or drum of the size of a three-light gas-meter drum, and having passages or hoods of double the usual size). Should it be thought necessary, however, to provide a compensation for any

such variation in the level of the water in the trough, this may be readily done by suspending the trough from the short end of a rod or lever (to which the adjusting screw, X, might be attached), and attaching the other or long end by a connecting rod to the spindle of the float in the regulating box, L, so that as the float rose, the trough would fall, and adjust the water to its proper level. Or, the same effect might be obtained by affixing to the stem of the regulating float a thin disc to cover a portion of the entrance to the spout, so as never to allow more water to pass into the measuring drum than the properly-adjusted quantity.

MATHEMATICAL PERIODICALS.

(Continued from page 247.)

XVII.—*Burrow's Diary.*—(*Continued.*)

Article IX.—Of the Geometrical Section of Sums and Differences. By Reuben Burrow.

*** In the introduction to this paper the writer observes, that "Apollonius has shown how to draw a line through a given point, to cut off from two given lines, parts which shall contain a given rectangle, or have a given ratio to each other: there yet remains to be found the position of lines drawn in a similar manner to cut off from given lines, parts whose sums or differences may be given, or the sums or differences of whose squares, &c., may be given; the first of these I intend here to treat of, reserving the last to another opportunity." Accordingly several lemmas and the following problems are introduced, the latter of which are merely analyzed and constructed, it being the Author's opinion "that to give a demonstration in form, after a clear analytical investigation, would be most ridiculous pedantry, notwithstanding that some people have very positively asserted the contrary." At the close of the paper we are informed that "mathematicians will shortly be favoured with a work wherein the whole subject will be treated in its utmost extent, and every particular case enumerated, &c., by the same very ingenious Author who has lately obliged the world with Apollonius's Tangencies, and several other performances;" but it does not appear that either Lawson or Burrow ever published anything more on the subject. It may however be observed, that several of the following problems are *generalized* and *porismatized* in the 2nd., 3rd., and 4th propositions of Dr. Wallace's Paper on Porisms in the fourth volume of the *Edinburgh Transactions*, and "several curious questions naturally suggest themselves on reading the two papers in connection."

Lemma I.

If from the quantity A + B be taken the quantity C + D; then according as B is less than, equal to, or greater than D, the remainder shall be less than, equal to, or greater than A − C. Again, if from A − B there be taken C − D; then according as B is less than, equal to, or greater than D, the remainder shall be greater than, equal to, or less than A − C.

Lemma II.—*Problem.*

If C N and C A be two lines given in position, and P, a given point; it is required to draw the line P N so, that the rectangle P A, A C may be equal to the rectangle P N, N C.

Lemma III.—*Theorem.*

If D N and D A be two lines given in position, P a given point, and the line A N be so drawn that the rectangle P A, A D be equal to the rectangle P N, N D; then if any line P R S be drawn on that side of N next to D, and *p r s* be drawn on the other side, I say that A R is greater than N S, and A *r* less than N *s*.

Problem I.

If A K and B C be two given lines parallel to each other, in which are the given points A and B, and P also be a given point *without* the lines; it is required to draw through the point P the line P K C, so that the sum or difference of A K and B C may be given.

Problem II.

Suppose A B and A C to be the lines, and let A B + A C be given equal to S.

Problem III.

The same thing being supposed as in the last, it is required to draw P C, so that the difference of A B and A C may be a given quantity.

Problem IV.

If P be a given point, A B and D C lines given in position, in which are the given points R and K; it is required to draw P C, so that the sum of R a and K C may be given.

Art. X. A Specimen of a Method of determining the Limits of Geometrical Quantities. By Reuben Barrow.

*** As this paper is also an extremely valuable and important one, perhaps the following abstract will not be unacceptable:—

Problem I.

If R B and R A be the two lines given in position, and P be a given point; it is required to determine the position of P B when P A, P B is the least possible.

Problem II.

R A and R B are two lines given in position, and P is a given point; it is required to draw P A and P B making a given angle A P B, so that P A, P B may be the least possible.

Problem III.

If B R b be a given circle, A a a line given in position, and P a given point; it is required to draw the line P A B, so that the ratio of P A to P B may be the least or greatest possible.

Problem.—Lemma I.

If C B V be a given circle, P a given point, and R S a line given in position: it is required to describe a circle which shall have its centre in the line R S, pass through the point P, and touch the circle C B V.

Problem IV.

If A A be a line given in position, B B R a given circle, and P a given point; it is required to find the position of the line P A B, so that the rectangle of P A and P B may be a maximum or minimum.

Problem V.

Having a given point, a right line given in position, and also a circle given in magnitude and position; it is required to draw two lines from the given point, which shall contain a given angle, one of whose extremities shall fall in the circumference of the given circle, and the other in the given line, and whose rectangle may be the least or greatest possible.

Lemma II.—*Theorem.*

If P R and P S be any two lines, and $c\,m\,r\,n$, C M R N circles touching these lines, whose centres are C and c; then if any line P m N be drawn through P, the point of concourse of the lines, cutting the circles in $m\,n$, M N, the rectangle P m, P N = P n, P M = P a, P Q.

Lemma III.—*Theorem.*

If two circles touch each other, and their diameters be parallel, any lines drawn through the point of contact divide those diameters proportionally.

Lemma IV.—*Problem.*

Having a line given in position, in which there is also a given point; it is required to describe a circle, whose centre shall be in this line; whose diameter shall be divided in a given ratio by this point, and which shall also touch another circle given in magnitude and position.

Lemma V.—*Theorem.*

If A C B be a given circle, and P a point in its diameter; and if A P : P B : : aP : P b, then shall the rectangle P G . P D be everywhere = P A . P b.

Problem VI.

Having two circles given in magnitude and position, and also a point given; it is required to draw a line through this point to cut the given circles, so that the rectangles of the parts, between the given point and the circumferences, may be the least or greatest possible.

Problem VII.

Having two circles given in magnitude and position, and also a given point, it is required to draw two lines from the point, containing a given angle, and cutting the circles, so that the rectangle of the parts between the point and the circumferences may be the greatest or least possible.

*** It will be observed that the point P in Lemma II. is the *external pole of similitude*, and that the relation given is one of the fundamental properties in this class of inquiries. Mr. Burrow gives no proof of the relation, merely remarking that "this has been demon-

strated in several books:"—probably one of these may be *Simson's Apol. Locis Planis, Book* i., *Prop*. v.; but for a complete discussion of the subject reference may be made to Professor Davies's elegant paper "On Radical Axes and Poles of Similitude" in the *Ladies' and Gentlemens' Diary*.

Art. XI. A Supplement to a former Article, concerning the Equation of Payments. By Reuben Burrow.

Art. XII. Some Miscellaneous Problems, with their solutions. By Reuben Burrow.

*** The Author introduces this paper by observing that the reasons which induced him to publish it were; firstly, the great length of the solutions to the same questions in the Appendix to *Simson's Opera Reliqna*, "and the impossibility of procuring the Book aforesaid;" secondly, the comparative simplicity of his own solutions: and, thirdly, he "was further induced, by some remarks at the end of a Book compiled by the *Rev. Dr. Horsley*." *Sect. R. S.*, entitled, *Apollonii Pergæi inclinationem*, &c., wherein that gentleman has been pleased to bestow his censures very liberally on the *immane* equations, and the *odious ambages* and modes of solution, which he says the modern *plebians* have *sweat* about; and after having condescended himself to give a solution of Newton's 7th Problem as a specimen, and to refer to two propositions of Euclid, by which he says the rest might be effected, *modestly* concludes that "those Geometers aforesaid, know nothing of Euclid's data." Mr. Burrow further remarks, that *Castillioneus* "had actually solved Newton's Problems by those very propositions referred to, *ten years before the Doctor pointed out the same method*;" and finds an "*additional* motive in the clumsiness" of the Doctor's method "to insert what follows; to which, if some (not *immane*) solutions be added, which are given in the *London Magazine* for 1775, by *Mr. George Sanderson*, Tailor, in *Doctors' Commons*, particularly a geometrical one to the 7th Problem aforesaid, which this industrious compiler did not solve without Algebra, there will not remain in the *Arithmetica Universalis*, a single question, relating to triangles, of any difficulty." Dr. Horsley appears to have announced his intention to give demonstrations to Newton's Problems in his proposed edition of Sir Isaac's works; and hence the above is pointed out "in order to save the Rev. Doctor some trouble in his new Edition; and though it has been his method hitherto, in all his *Notes, Remarks, and Compilations*, to be very sparing of the names of those Authors whose works he has made free with, yet (it is to be hoped) at the same time, he will not forget to do Mr. Sanderson the justice to which his merit so deservedly entitles him." Whether Dr. Horsley profited by this advice is a question into which it will be needless to enter; it is however notorious that the *practice* here condemned did not die with him, but appears to have flourished most luxuriantly in those *honourable* localities where one would least expect it. But better days begin to dawn: a few honourable names have already stood out in bold relief awarding "*honour to whom honour is due*," and already the *Schoolmaster* at Bath, the Lancashire and Spitalfield's *weavers*, the *tailors* of Doctors' Commons, and a shoal of other successful explorers from the "far North," and West begin to reap the reward of their labours in science by being honourably cited on all legitimate occasions; nor need we despair of seeing the time when there will neither exist, an Editor so mean, as to suppress all due reference to proper authorities, nor an Author so unprincipled, as not faithfully to acknowledge the sources, however humble and obscure, whence he derived the bases upon which his superstructure has been reared.

Proposition I.—*Theorem*.

If A B, A C, be two lines drawn from a given point to touch a circle in T and *t*, and C B be any line touching the circle and intercepting between A C and A B; then will A C + C B + B A be constant when C B is on that part of the circle next A; and A *c* + A *b* − *b c* will be constant when *c b* is drawn on the contrary part.

*** Four corollaries are added, in the last of which it is observed that Newton's fourth problem may hence be *generally* solved.

Proposition II.—*Problem*.

If T P *t* be a circle given in magnitude and position, and A T, A *t*, tangents drawn to it from a given point; it is required to draw a line, C B, to touch

the circle, so that the part, C B, intercepted between A T and A t may be of a given length. (See fig. to Prop. I.)

*** Two corollaries are added to this proposition pointing out solutions to the *third*, *eighth*, and *tenth* problems of *Newton's Arith. Universalis*.

Proposition III.—*Problem.*

The same things being given as in the last, it is required to draw the tangent, C B, so that its parts, C P and B P, may obtain a given ratio.

*** A scholium is added, in which it is remarked, that "by the foregoing problems a great number of questions relating to the perimeters of triangles and trapeziums may be readily resolved," and it is also noticed, that "when the tangent is drawn on the part farthest distant; the *difference* between the sum of the sides and base will then be concerned in like manner as the *perimeter* was in those foregoing."

Proposition IV.—*Theorem.*

If A B and A D be two lines given in position meeting at A, and BD be drawn perpendicular to A B cutting A D in D, then will the ratio of A D to D B be the greatest possible; and of all the lines A d and dB the ratio of those which intersect nearest D is greater than that of those intersecting farther off.

Proposition V.—*Problem.*

A and B are two given points, and D C a line given in position; it is required to find a point G in A B, so that G C being drawn to cut D C in a given angle, the rectangle A G, G B = G C^2.

*** Three corollaries are added to this proposition, in the last of which is given a solution to the following problem:—"If A D be a given line, and B a given point, another point, G, may be found where A G, G B may have a given ratio to G D^2." The author further remarks, that "in a similar manner, the rest of *Apollonius's* problems on *Determinate Sections* may be resolved, as will be evident to any person who takes the trouble of observing the method which *Mr. Wales* took in collecting his book thereon from the solutions that had been given before by *Mr. Simpson* and *Snellius*."

Proposition VI.—*Problem.*

C D is a line given in position, and A, B, two given points; it is required to find a point, C, in the line C D, where the ratio of A C to C B may be the greatest possible.

*** Two corollaries and a scholium are added to this proposition; in the last of which it is observed that "the above problem is *Dr. Simpson's* 5th; the solution here given takes up seven quarto pages. (*See Opera Reliqua*, pp. 14—20, *Appendix.*) As to the 4th, it has been already done in the same way by *Mr. Simpson*; the 2nd and 3rd are the same as that proposed by *Mr. Saunderson*, in last year's Diary (*Ques.* 2, *Diary*, 1776), different solutions of which may be seen in the answers for this year; and the *first* is solved in the *fourth* corollary of the first proposition."

Proposition VII.—*Lemma.*

A and B are two given points, and S C a given circle; it is required to find the point G in A B, so that G S being drawn to the centre, and meeting the circumference in C, the square of G C may be equal to the rectangle A G, G B.

Proposition VIII.—*Problem.*

A and B are two given points, and SDC a circle, given in magnitude and position, it is required to find a point, C, in the circumference of the circle where the ratio of the lines, AC and CB, is the greatest possible.

Proposition IX.—*Problem.*

Bv and BC are two lines given in position, and A a given point: it is required to find the point, P, in the line, Bv, so that AP being joined, and PC drawn parallel to a line given in position, the ratio, sum, or difference of AP and PC may be given.

*** Two corollaries and a solution are appended to the demonstrations, in which a solution to the 48th Problem of *Newton's Arith. Universalis* is pointed out. It is also added, that "the application of this problem is very extensive, particularly in mechanics . . . . . The problems of Gunnery (abstracting the air's resistance) may also be constructed by it in a much simpler manner than any published hitherto, as (will be shown) hereafter." This was subsequently done by the author in his "*Restitution*," the concluding portion of which contains a tract on "*The Theory of Gunnery; or,*

the Doctrine of Projectiles in a Non-resisting Medium."

Proposition X.—*Theorems.*

*** This proposition contains a collection of various properties of the triangle inscribed in a circle, relating to the sums, differences of its sides, &c., which were here brought together into one view for the sake of making references in order to shorten the solutions of problems." Mr. Lowry, under the signature "M. A. Harrison," afterwards added many elegant properties of the same class in his papers on "Geometrical Propositions," contained in the *first* and *second* volumes of the old series of *Leybourn's Mathematical Repository*, and the discussion of the same diagram, with additions, forms the principal subject of the well-known "Modern Geometry" of the *Student*. In a scholium, Mr. Burrow remarks, that he has "seldom given solutions to more than *one* case" of each problem, nor did he "think it necessary to be more particular;" and though "such a procedure will be looked upon as deviating from geometrical strictness by such as have formed their ideas of the method of the ancients from the specimen given by the *Restorer* (as he is called) of *Apollonius de Inclinationibus;* however, I cannot see the use of multiplying cases without necessity, nor what end it can answer to repeat the same thing for each trifling alteration, when a single example would serve;" and every purpose "be fully accomplished by only increasing the number of diagrams. Nay, I do not even see the necessity for this last; *Euclid* does not use it, and if by 'the inclination of two straight lines which meet together,' we understand *either* of the angles made at the point of intersection (a sense in which there is great reason to believe that *Euclid* intended to be understood), there will not then be the least occasion for several additions which *Dr. Simson* and others have made to the 'Elements;' for instance, Prop. A. B. vi. will be included in Prop. 3 preceding it; and the additional theorem inserted in the data by *Lord Stanhope* (p. 92), will scarcely amount even to a second case of Prop. 97." The practice of increasing the number of diagrams to show the principal cases of each proposition has been carried out by Mr. Colin Campbell, of Liverpool, in his elegant work, entitled "*Lucubrations in Mathematics*," and its advantages may be fully seen in Professor Davies's paper in the *Diary*, to which reference has previously been made.

THOMAS WILKINSON.

Burnley, Lancashire, Sept. 20, 1849.

(*To be continued.*)

THE BRITISH ASSOCIATION.—BIRMINGHAM MEETING.

(Further Selections from the *Athenæum* Report of the Proceedings.)

Paper read by Mr. Robert Davison, C.E., on the Desiccating Process of Messrs. Davison and Symington.

Mr. Davison stated that all other methods of drying consist in generating heat by simple radiation, or throwing off heat from a heated surface, whether the surface be brick flues, cockles, steam, or hot-water pipes. Heat, he said, is easily attainable in this way, and to almost any grade of temperature; but heat is not the only essential for drying, or why does the bleacher or laundress hang out their articles to dry on a cold March morning? It is true that heat facilitates the evaporation of the watery particles; but a current is likewise necessary, otherwise all the water which is thus converted into vapour will only tend to charge the chamber with steam, and it is not until this steam has arrived at a certain excess or pressure that it will make its escape, and the operation of drying really commences. The amount of current obtainable in this way is proportioned to the rarefaction and quantity of air admitted and allowed to come in contact with the heated medium. If little is admitted, there is little current, an increased temperate, and likewise an increased volume of vapour; or *vice versâ*, if a larger amount of atmospheric air is admitted, there will be a corresponding increased current, a lessened temperature, and much less vapour. The ordinary current obtainable in this way may be taken at three or four feet per second. To subject any article to a slow current of heat in a comparatively close chamber, or where there is an exceedingly small aperture for the escape of vapour, whereby that article (whatever it may be) is enveloped in an atmosphere of its own steam, is (to give it its proper name) not drying but *stewing*. If there is next to no escape at all, as in the case of an oven, it is in reality *baking*. Mr. Davison stated, that it is not only a moving but a rapid current which is the great desideratum for all drying purposes:—and that it is the impulsion of atmospheric air, at the velocity of the hurricane, or upwards of 100

miles per hour (or any other speed), combined with the element of heat under perfect control, which, in a few sentences, constitutes his desiccating process. Mr. Davison proceeded to describe the means by which the two operations of current and heat are created and kept up—and some applications which have been made of the process, together with the practical results.

The PRESIDENT (Robert Stephenson, Esq., C.E.,) expressed his opinion of the high state of perfection to which Messrs. Davison and Symington had brought their plan, and intimated that if they could go on economising it, he believed its use would become universal.

Paper read on the Manufacture of the Finer Irons and Steel, as applied to Gun-barrels, Swords, and Railway-axles, by Mr. W. GREENER.

The first innovation on the old principle of manufacturing gun-barrels entirely from old horse-nail stubs was due to the late Mr. Adams, of Wednesbury, who brought out what is termed Damascus iron, which is constructed of alternate layers of steel and iron fagotted, drawn down into rods, then tortuously twisted, and when welded into barrels forms the Damascus barrel. The success of this experiment, both in point of beauty and strength, was so great as to be under-estimated at 50 per cent. as compared with the strength of stub twist iron. The next experiment was to blend more intimately than the above steel with the horse-nail stubs in the proportion of one to two of the latter. The paper described the mode of this; and then went on to narrate that the next and most important improvement in metals was the manufacture of gun-barrels from scrap steel entirely, and for this purpose old coach wheels were generally in request: by clipping these into pieces, perfectly cleansing them and welding in an air-furnace, a metal is produced which surpasses in tenacity, tenuity, and density, any fibrous metal ever before produced. The tenacity of it when subjected to torsion in a chain testing machine is as 8 to 2½ over that of the old stub twist mixture. The perfect safety of barrels produced from it is astonishing; no gunpowder yet tried has power to burst them when properly manufactured. These experiments had induced others on a more extensive scale; to effect this, ingots of cast steel were taken from the mill made to No. 3 in the scale of carbonization. These after rolling into flat bars, were clipped into small pieces, immediately mixed and welded as before in the air-furnace, drawn down into rolls, and re-fagotted; these were subsequently drawn down, and were then ready for being made into gun-barrels, either with or without spirally twisting them; to form Damascene barrels from this was perfectly safe—this was ascertained by experiments. It was discovered that the density and tenacity of the metal was sufficiently great to effectually resist the enormous force of this great cast of gunpowder. The manufacture of swords was another article to which this improvement applied. All the investigations of the writer had tended to satisfy him that the Arabs thus produced their finely-tempered Damascus swords; namely, using two steels of different carbonization—mixing them in the most intimate manner, and twisting them many fantastic ways, but observing method in that fancy; and it was a fact that no European sword has ever yet been produced equal to the Damascus. The Government inspector of small arms was of opinion that the swords made in Birmingham were not fit to be used in the army. The writer's investigations had satisfied him that tempering by crystallizing the steel—that is to say, tempering in the ordinary way—was far from the wisest. The Damascus blade in its fibrous state, or hammer hardened, is more difficult to break by 100 per cent. than the best English-made blade. This had been tried; but temper it in the same way, and it showed no greater tenacity than our own; the Damascene figure was destroyed by the carbon becoming equally diffused; nor would acid develope it—it was entirely gone. From these and other facts the conclusion might be drawn that swords constructed of dissimilar steels, tempered by condensation of its fibres, either by repeated rollings, hammering, or many other processes, which our perfect machinery gives us the facility to do, are the best. Therefore in time we might hope to see every soldier of the empire armed with a weapon as good, if not so costly, as the highly-prized Damascene —The remaining part of the paper referred to a subject already much discussed, the manufacture of railway-axles.

Paper read on some Modifications in the Colouring of Glass by Metallic Oxides, by M. G. BONTEMPS.

In this communication some important practical points connected with the coloured ornamentation of glass and porcelain were brought forward. In the first place it was shown that all the colours of the prismatic spectrum might be given to glass by the use of the oxide of iron in varying proportions, and by the agency of different degrees of heat; the conclusion of the author being that all the colours are produced in their natural disposition in proportion as you

increase the temperature. Similar phenomena were observed with the oxide of manganese. Manganese is employed to give a pink or purple tint to glass, and also to neutralise the slight green given by iron and carbon to glass in its manufacture. If the glass coloured by manganese remains too long in the melting-pot or the annealing-kiln, the *purple* tint turns first to a light *brownish red*, then to *yellow*, and afterwards to *green*. White glass in which a small proportion of manganese has been used is liable to become light yellow by exposure to luminous power. This oxide is also in certain window glass disposed to turn pink or purple under the action of the sun's rays. M. Bontemps has found that similar changes take place in the annealing oven. He has determined, by experiments made by him on polyzonal lenses for M. Fresnel, that light is the agent producing the change mentioned; and the author expresses a doubt whether any change in the oxidization of the metal will explain the photogenic effect. A series of chromatic changes of a similar character were observed with the oxides of copper; the colours being in like manner regulated by the heat to which the glass was exposed. It was found that silver, although with less intensity, exhibited the same phenomena; and gold, although usually employed for the purpose of imparting varieties of red, was found by varying degrees of heating at a high temperature, and reoasting several times, to give a great many tints, varying from blue to pink, red, opaque yellow, and green. Charcoal in excess in a mixture of silica-alkaline glass gives a yellow colour, which is not so bright as the yellow from silver; and this yellow colour may be turned to a dark red by a second fire. The author is disposed to refer these chromatic changes to some modifications of the composing particles rather than to any chemical changes in the materials employed.

Dr. Faraday spoke on the importance in all our inquiries of associating physical and chemical science. In the beautiful facts brought forward by M. Bontemps it appeared that many of the changes of colour mentioned are purely physical. The phenomena of the change of manganese from white to pink in glass appeared to him inexplicable as a chemical effect. Mr. Dilke inquired upon what peculiarity depended the differences discovered to exist in the coloured glass of the windows of old churches and that of modern manufacture? M. Bontemps stated that the observed differences were entirely due to age and imperfections in manufacture. Dr. Faraday remarked, that any irregularities tended to produce the diffusion of the rays which permeate the glass; and that the opacity of ancient church windows was probably due to a superficial change of the external surface. M. Bontemps stated that old glass was by repolishing rendered as transparent as any modern glass.

Paper read on the Friction of Water, by R. Rawson, Esq.

The object of this paper was to ascertain the friction of water on a vessel or other floating bodies, rolling in water. For this purpose, experiments have been made upon a cylindrical model, whose length is 30 ins., diameter 26 ins., and weight 255·43 lb. avoirdupois, in the following manner: The cylinder was placed in a cistern, in the first place, without water, and made to vibrate on knife-edges passing through the axis of the cylinder. A pencil projecting from the model in the direction of the axis of the cylinder on the surface of another moveable cylinder marked out upon paper placed upon this last cylinder the amplitude of each oscillation. The cylinder was deflected over to various angles by means of a weight attached by a string to the arm of a lever fixed to the cylindrical model:

Angle of Deflexion.	Angle to which the Model vibrated.
22° 30′	22° 24′
22 10	22 6
21 54	21 48
21 36	21 30
&c.	&c.

When the cylinder oscillated, in all circumstances the same as above, except being surrounded by salt water, the amplitude of oscillations were as follows:

Angle of Deflection.	Angle to which the Model vibrated.
22° 30′	22° 0′
21 36	21 8
20 48	20 16
&c.	&c.

Clearly showing that the amplitude of vibration when oscillating in water is considerably less than when oscillating without water. In the above instance there is a falling off in the angle of amplitude of 24′, or nearly half of a degree. This amount has been confirmed by several experiments made with great care; and it appears only fair to attribute this decrease in the amplitude of oscillation to the circumstance of the friction of the water on the surface of the cylinder. The amount of force acting on the surface of the cylinder necessary to cause the decrease in the amplitude of oscillation shown by the experiment was calculated; and the author thinks that this amount of force is not equally distributed on the surface of the cylinder. In consequence of this, he thought the amount on any particular part might vary as the depth.

On this supposition, a constant pressure at a unit of depth is assumed. This, multiplied by the depth of any other point of the cylinder immersed in the water, will give the pressure at that point. These forces or moments being summed by integration and equated with the sum of the moments given by the experiments, we shall have the following value of the constant pressure at a unit of depth, ·0000469. This constant is another experiment, the weight of the model being 197 lbs. avoirdupois, and consequently the part immersed in the water was very different from the other experiment, was ·0000452, which differs very little from the former, showing that the hypothesis assumed in the computation is not far from the truth.

Another paper was read on the Oscillations of Floating Bodies, by Mr. RAWSON.

This paper had for its object the description of a course of experiments made at Portsmouth dockyard by Mr. John Fincham, the master shipwright, and the author, with a view to confirm several important formulæ discovered by Professor Moseley relative to the rolling and pitching motion of vessels. All the experiments, which were made by Admiralty order, confirm the formulæ for determining the amount of force or work done to deflect a floating body in a state of equilibrium through a given angle, and also another formula which determines whether the vessel thus deflected will move slowly or otherwise. The importance of these questions to naval architecture is obvious; and all the experiments we have made show what we believe to be an important practical fact, viz., that when a sudden gust of wind is applied to the sails of a vessel, or any cause which acts constantly during one oscillation, the ultimate amplitude of deflexion will be double the amplitude which the gust of wind will permanently deflect the vessel. In the next part, several experiments were made on models of vessels; some of which have been built with a view to ascertain the best form of midship section which will give the easiest rolling motion.

Paper read on the Heat of the Vaporization of Water, by J. P. JOULE.

The object was to point out the complex nature of the heat hitherto taken from the latent heat of steam. In the exact experiments of Regnault 965° was found to be the quantity of heat evolved in the condensation of steam saturated at 212°; of this quantity 75° is the heat due to the *vis vivâ* communicated by the pressure of the steam, leaving 890° as the true heat of vaporization of water. In a perfect steam engine supplied with water at 212°, and worked at atmospheric pressure without expansion, 965° will be the heat communicated from the fire to the boiler, 75° will be the heat utilized by conversion into force, and the remainder 890° will be the heat given out in the condenser.

We add, from the *Midland Counties Herald*, the following account of a very valuable paper read by Professor Willis, at the Town Hall, on the *Deflection of Railway Bridges under the passage of heavy bodies*:—

Some time ago a commission, of which Prof. W. had the honour to be a member, was appointed by Government to inquire into the application of iron to railways; and though he was not about to detail to them all the labours of that commission, he would give them some account of the results of a portion of its researches. They had found it necessary to ascertain the effect which the passage of loads over iron railway bridges had in deflecting them. They had clearly ascertained the character of the effect a railway engine and tender would have upon an iron bridge when in a state of rest, but they did not know whether, when the train was in a state of motion, the deflection would be greater or less. For the purpose of determining this interesting and important question, a temporary railroad, the bridge being represented by two iron bars, had been constructed in Portsmouth Dockyard, and so arranged that, by means of an inclined plane, any required degree of velocity could be attained by the carriage with which the experiments were conducted. With this apparatus a long and interesting series of experiments were made, the weight of the loads being varied, and the uniform result was that the statical deflection (*i. e.*, the deflection caused by the carriage when at rest on the centre of the bars) was three or four times less than the deflection caused when the carriage was in a state of motion. The apparatus which he exhibited to them that evening was on a much smaller scale than the Portsmouth one, for whilst the latter enabled them to pass a weight of from three to four tons over the bridge, the former only carried a weight of as many pounds. As the object of the experimental philosopher was to eliminate all obstructing causes, they must begin their experiments on a small scale, so that it was necessary to employ a smaller apparatus, and also to obtain a different material to cast-iron, and a material, too, that would give, by its greater delicacy of texture, closer results, and that would not display the curious phenomenon of "set." He had, therefore, in his more recent experiments, used bars of cast-steel, and in order to do away with any irregular

pressure of the carriage—for in the deflection they sometimes found more pressure on the one bar than the other—he had used one bar instead of two. The reverend professor here proceeded to give a description of the apparatus, which consisted of a railway, between twenty and thirty feet long, formed of deal planking, and having at one end an inclined plane, with an altitude of about twenty feet. Upon this plane a moveable break was fixed, so as to hold the carriage at any required height, and to ensure accuracy in the starting point. The centre of the line of rail was occupied by the bridge, and the extreme end opposite the incline was so made as to open slightly outwards, so that springs fixed on either side the carriage might clasp the sides of the line and retard further motion, thus preventing the carriage from running off the line after passing the bridge. The carriage employed was merely a small model of a luggage wagon, the flanges of the wheels being made outwards instead of inwards, so as to clip the line along which they passed. A long and interesting series of experiments was here performed, the velocity of the motion being considerably varied, the result invariably being that the deflection of the bar was during the motion of the carriage triple the extent of the deflection caused whilst the carriage merely rested upon the bar. Mr. Willis now proceeded to observe that the weight of railway bridges was generally much greater than that of any load that passed over them, whilst his bar was much lighter than the load that had so greatly deflected it. An ingenious contrivance for strengthening the bar, by increasing the weight to be deflected with it, was then resorted to, which showed that the increase in the weight of the bridge had diminished the deflection, although, the Professor observed, that to take this as a general principle would be wrong, for there were cases in which an increase in the weight of the bridge actually increased rather than diminished the deflection. He was, however, happy to say that the very serious facts connected with the deflection of iron railway bridges, the results of which he had that evening attempted to develop, did not exist in practice to so great an extent as in theory; and, indeed, they found that the deflection was in practice so slight that it might be almost altogether neglected. This fact the Commission had established by actual experiments upon a bridge on a railway in Surrey. In conclusion, he might observe that some experiments had been made at Portsmouth as to the advantage to be derived from curving bars upwards, which certainly diminished the centrifugal force, and consequently lessened the deflection, but no practical results were elicited.... Lord Wrottesley returned thanks, on behalf of the audience, to Professor Willis, at the same time briefly remarking upon the value of the facts demonstrated during the course of the experiments at Portsmouth.

MENAI BRIDGE HYDRAULIC PRESSES OR LIFTS.

Sir,—I have observed paragraphs in newspapers recently, tending to exculpate parties entrusted with the manufacture of the machinery for raising the tubes of the Britannia Bridge. As an old workman, who assisted to make and prove upwards of a hundred hydraulic presses at the late Mr. Bramah's factory, at Pimlico, I strongly suspect that the cause of failure was the excessive pressure applied to the ram cylinders—8000 or 9000 lbs. on the square inch, as reported. At Bramah's we never found presses in *constant work* stand with more than 3 tons (6720 lbs.) on the square inch, and the greatest pains were taken to obtain the most approved kinds of iron (mixed qualities) to cast the cylinders from. I have seen press cylinders bear 7000 lbs., and as much as 8000 lbs., on the square inch, *under proof, for a short time*, but we never could trust them *in work* with so much; and cast iron at that time was very superior to the specimens from foundries at the present day. Increasing the thickness of the metal in the press cylinders was seldom successful; I have known metal 7 inches thick stand as well as 10½ inches, for presses for punches, and 10 inches diameter; the thicker the metal the greater appeared to be the difficulty of getting it equal and homogeneous throughout.

I question the experience of the makers of the Menai presses, and should like to know how many *large* hydraulic presses they have made; and whether they were ever *worked up to* 3 *tons on the square inch, in* CONSTANT USE. The diameter of the press which gave way is stated to have been 20 inches—why not have made it 22 inches diameter? Or what would probably have been better, four 11-inch rams to each press, similar to the construction adopted by Hick, of Bolton-le-Moor, some years ago. I should like to know what the *experienced* hydraulic press-makers in London, Manchester, and Glasgow, think

of the presses or lifts made for raising the Britannia tubes. Those who talk lightly of the *head* of a press being defective, ought to know that indications of weakness in any part of a press casting are suspicious; I know numbers of press cylinders used to be thrown aside at Bramah's for very trifling defects. Then as to "*annealing*," mentioned in connection with the casting of the new cylinder to replace the fractured one, *is it possible* that the original cylinder was taken out of the mould prematurely and not allowed to become quite cool? A little like *apprentice work*, if it was so; and the defect of the *head* may have been owing to the short supply of metal to keep the runners well fed. Mr. Stephenson seems to have been unfortunate in the selection of many of the *tools* he has employed in the Menai work, from first to last—some of them more desirous of securing self-commendation and larger profits, than of assisting and following out his views. I have met with many such in my career, but time has exposed the worthlessness of their pretensions. I may be prejudiced, but I am decidedly of opinion the hydraulic-press principle is the best for raising the Menai tubes.

I am, Sir, yours, &c.,
A MILLWRIGHT.

September 24, 1849.

REPORT OF THE COMMISSIONER OF PATENTS OF THE UNITED STATES, ON EXPLOSIONS OF STEAM-BOILERS, DECEMBER 30, 1848.

(Continued from page 282.)

The fourth cause of explosions given by the report of the Franklin Institute, is the "*carelessness and ignorance of those intrusted with the management of the engine;*" and this is that which, in the deliberate opinion of the undersigned, is operative in the great majority of these fatal occurrences. It will be perceived, by reference to the summary of results deduced from the tabular statement of explosions, [C] that the explosions which have been distinctly attributed to this cause amount to the large proportion of 32½ per cent. of the whole number of those in which the cause is given. Yet even this proportion, large as it is, does not give a fair estimate of the extent to which this cause is operative; for the existence of the other causes can also be traced, in a great majority of cases, to criminal neglect, ignorance, or carelessness in some quarter. "Undue pressure within a boiler," gradually increased until it exceed the limit of the estimated tenacity of the boiler, (a point very far above its proper working pressure,) while, at the same time the supply of water is sufficient, could scarcely occur otherwise than by neglect in allowing the safety-valve to become corroded on its seat, or by intentionally overloading it. "The presence of unduly-heated metal within a boiler" is attributable to a deficient supply of water, which allows some portion of metal which is in contact with the fire to become uncovered; or to deposits, which operate by interposing a non-conducting substance between the metal and the water, thus allowing the heat to accumulate in the former, and thereby reduce its tenacity. Now the remedies for both these evils are in the hands of the engineer, who cannot fail to apply them, unless through culpable negligence. "The defective construction of the boiler and its appendages," is the result of unfaithfulness in the manufacturer, induced, perhaps, by the false economy of the owners with whom he contracts.

It thus appears that all the causes of explosions which have been assigned by the distinguished scientific authority so often cited, may be resolved, without unfairness, into this one—the carelessness or ignorance of those entrusted with the management or manufacture of the boiler. The whole of this blame does not, however, justly rest upon the engineers in all cases; for there is too much reason to believe that they are often interfered with, in the most unwarrantable manner, in the performance of their duties, by the captains who employ them, and are forced to pursue a course condemned by their judgment and conscience, through fear of losing their situations. The view here taken of the frightful extent to which this cause of explosions operates, is not only a legitimate inference from the statistics given, but is directly borne out by the testimony of the numerous intelligent and practical men who have furnished the office with their opinions in detail.* Upon this view are based the recommendations to be hereafter made.

The causes of boiler explosions having thus been briefly considered, the remedies which have thus far been proposed, suggest themselves as the next topic for consideration. These are either mechanical or legal.

The various contrivances to prevent explosions by mechanical means, are known as the "safety apparatus" of the engine. These contrivances have been well classified

* Appendix. [G.,] Com's. of Messrs. Clst, Halperman, Green, Hicks, and Sanders.

as being; first, such as merely indicate danger without relieving it; second, such as are brought into action and relieve the boiler from excess of steam by the force of pressure alone, or by temperature independent of pressure; third, such as are brought into action by deficiency of water, combined with pressure; fourth, such as supply water without indicating either pressure or temperature.

To the first class belong the common syphon gauge of low pressure boilers; the manometer for high-pressure boilers; the glass-water gauge; the compound-water gauge or altometer, of Mr. Quinby; his alarm altometer and vaporimeter; the percussion water gauge of Worthington and Baker, together with the common try cocks, and all those instruments which depend on the opening of small valves to sound an alarm.

In the second class may be placed the common safety valve, the safety guard of Mr. Evans, the fusible disks used in France, and the expansion guard of Mr. Wright.

In the third class are to be found the safety apparatus of Mr. Raub, the hydrostatic valve of Mr. Duff, and the interior safety valve of Mr. Easton.

To the fourth class belong the ordinary force pump, the subsidiary pumping engine used in many steam-boats, and the self-acting pumping engine of Mr. Barnum.*

The records of the Patent-office show that no small share of the ingenuity of inventors has been directed to the invention or improvement of safety apparatus for steam boilers; and yet it could not be said with truth that any of these contrivances have fully met the demands of the public for a perfect safeguard against the fatal explosions so frequently occurring, especially on our western waters. An invention which should meet these demands, ought to be prompt, certain, and irresistable in action under all situations and temperatures; it should be liable to no casual impediment, and placed beyond the reach of improper interference: should indicate the approach as well as the presence of danger, of which it should give some unequivocal warning; should show the degree of heat and consequent pressure on the boiler from boiling to the highest permissible point; and should give immediate notice of a deficiency of water. It should exhibit its indications in a form obvious and striking; should be self-adjusting, and readily adjustible, simple, and enduring, and not too expensive in its construction. To go into minute detail with reference to the various inventions which are now rivals in the contest for public favour, or to enter into any discussion of their relative merits, would comport neither with the objects of this report, nor with the strict impartiality which inventors have a right to demand from this office. A general notice of them is all that will be attempted.

The common Syphon gauge or dynamometer, is a tube of iron or glass of equal calibre throughout, open at both ends, and bent in the shape of a U, one limb being longer than the other, and the extremity of the shorter limb placed within the boiler. Into this tube mercury is introduced, and stands at an equal height in both limbs. When the pressure within the boiler is just equal to that of the atmosphere, the height of the mercury remains unchanged; but when the pressure within exceeds that of the atmosphere without, the mercury rises in the outer limb of the tube, to a height proportioned to the difference—each inch of rise indicating an increased pressure within, equal to about 1 lb. per square inch. When the tube is of iron, a float placed on the surface of the mercury in the outer limb is connected with a rod which passes out at the top, and indicates the rise and fall on an attached scale. This instrument answers admirably as an indicator of pressure in low-pressure engines; but in those on the high-pressure principle, as about 15 inches must be added to its length for each additional atmosphere of pressure, the great height to which the outer limb has to be carried renders its application inconvenient: nor is the serpentine form less objectionable. It, moreover, merely indicates pressure without giving an alarm, and is, therefore, no safeguard against explosion—except as offering to the eye of an attentive engineer an index of the existing force of the steam. Its bore is too small to permit it to act as an efficient means of escape for the steam, should the mercury be blown out by the excess of pressure within. While, therefore, it is a valuable appendage to a boiler as an indicator of pressure, it cannot be considered as, of itself, a reliable security against danger.

The closed gauge or *manometer* is similar in general form to that just described, but its outer limb encloses air, and is not open to the external atmosphere. The air in this limb is condensed, and the indication of pressure within the boiler is given by the varying volume of the air in the outer limb; the tube being transparent and graduated to atmospheres. The objections made to this gauge by the Franklin Committee are, that it requires great nicety in its construction

* Sen. Doc. 405, 28th Cong.. 1st Session, p. 3. Report of Profs. Johnson and Jones to Secretary of Navy, June, 1844.

and graduation, and a correction for the temperature of the air enclosed in it. These objections were of sufficient weight to induce the declaration that no gauge applicable to it (the high pressure boiler) has yet been brought into use,* a fact to which the attention of inventors should be called, as opening a field for the profitable and useful exercise of their ingenuity.

The glass water-gauge is a thick tube of well annealed glass, connected with the boiler by two lateral pipes—one of which passes in below and the other above the proper level of the water. These pipes are provided with cocks, by which connection between the tube and the boiler can be made at pleasure. The object of this apparatus is, to ascertain at a glance the true level of the water in the boiler. The objections which have been urged to its use are, that the unequal expansion of the glass and the metal with which it is connected renders the former liable to fracture; that it is also liable to fracture from shocks, and by sudden variations of temperature. To obviate these difficulties, it was proposed to pass the ends of the tube into stuffing-boxes, and to make them of well annealed glass of considerable thickness. The use of green glass obviates the difficulty of the glass clouding, when high steam is used, from the action of the steam on the alkali contained in the substance of the glass. The indication by this instrument of the height of the water within the boiler was found to be accurate. Even when foaming occurred by relief of pressure within the boiler, and when the gauge cocks could not be trusted, the oscillations in the tube did not amount to half an inch, and on closing the connecting pipes the water in the tube became tranquil at the mean level of its oscillations.† The use of this gauge is highly recommended by the Franklin Committee.‡

The vaporimeter of Mr. Quinby is an instrument intended to indicate the temperature of the steam within the boiler by the expansion and contraction of mercury contained in a large metallic tube inserted into the boiler above the water level. It is, in fact, a large metallic thermometer, the bulb of which is the large tube within the boiler, and its stem the small perpendicular tube on the outside of it. On the mercury in this outer tube is placed a float connected with a rod, the varying height of which indicates the temperature of the steam, and its consequent elasticity. Its advantages are its little liability to injury from accident, and the ease with which its indications are read off, owing to the large size of the degrees marked upon its scale. It is, however, a mere indicator of temperature, and the consequent pressure, dependent for its utility upon the watchfulness of the engineer, and, therefore, least useful where danger, from his neglect, is greatest. Its cost is also a serious objection.*

The *alarm altometer* of Mr. Quinby consists of a bucket-float, enclosed in a cylinder connected with the boiler by lateral pipes entering below and above the water-line, so that the water in the cylinder and in the boiler shall always stand at the same height. The fall of the float opens a small valve, to which a steam whistle is attached. The operation of this instrument, as reported by Messrs. Johnson and Jones, was not satisfactory. The alarm was feeble, owing to the smallness of the valve, yet its size, if increased, would enable the pressure upon it by highly elastic steam to counteract the weight of the float, and thus prevent any action. It is also liable to obstruction from deposits, is too complex in its construction, and attains no object that could not be secured by a float within the boiler.†

Another *altometer* has been invented by Mr. Quinby, which is a complex modification of the glass-tube gauge, identical in principle, and offering no advantage over it. It is heavier than the common gauge, more liable to fracture, more difficult to repair, requires greater precision in its workmanship, and is consequently very costly.‡

The *percussion water gauge* of Worthington and Baker,§ is an ingenious contrivance for ascertaining the height of water in the boiler by the percussive action of a horizontal flat surface brought suddenly into contact with the surface of the water, the height of which is to be gauged. It consists of a tube so connected with the boiler as that the water it contains shall stand at the same height as that in the boiler. In this tube is a piston which can be brought into sudden contact with the surface of the water by means of a projecting arm, under the control of the engineer. When it is desired to ascertain the height of the water, the engineer, by means of the arm mentioned, pushes down the piston until it strikes the water: the slight shock or concussion produced by the contact is readily felt by the hand of the engineer, and the position of the arm at the time gives, on an attached scale, the desired information. This instrument is said to

* General Report, p. 8; also Rep. on Experiments, *Frank. Jour.*, vol. xvii., p. 3.

† *Frank. Jour.*, vol. xvii., p. 9.

‡ The employment of these gauges was enforced by ordnance of French Government in 1830.

* Sen. Doc. 405, 28th Cong., 1st Sess. pp. 13, 43.

† Ibid. pp. 44.

‡ Ibid, p. 16.

§ Patented February 20, 1847.

operate well, but it depends entirely upon the attention of the engineer, and neither indicates the approach of danger nor relieves it. In the case of recklessness or neglect, it would be of no service.

The common try-cocks are two or more tubes, entering the boiler at short distances above and below the due water line. When upon turning the cocks, steam issues from the upper, and water from the lower ones, the water in the boiler is supposed to be at its proper height. The indications of these instruments are, at least, extremely rude. When the water is above the highest, or below the lowest, they fail entirely; and when foaming occurs, no dependence can be placed upon them. In this case the error is most dangerous, as the indicated level of the water may be several inches above its true level. Notwithstanding the imperfection of these instruments, they are still employed to a very considerable extent, and their indications relied upon in determining so vital a question to the safety of all concerned as the height of water in the boiler.

The ordinary *safety-valve*, and contrivances which employ *fusible alloys*, are the chief devices embraced in the second class, or those which relieve the boiler from excess of steam by the force of pressure alone, or by temperature independent of pressure.

The *safety-valve* was introduced by Papin in his digester, was applied by Savery to his engine, and has ever since been relied upon as the principal means of relieving the boiler from excessive pressure. Its construction is too well known to need description. The two forms most commonly employed are the conical and disc valves; the former, from the facility with which it can be tightened to prevent waste of steam, has been more generally employed than the latter. Its greater tendency, unless the cone be very obtuse, to become adherent to its seat, has been urged as a forcible objection to its use. The disc valve is not so liable to this cause of danger, and is preferred by the Franklin Committee. They adopted it in their experiments, and found that when kept in fair working order, no adhesion took place.

But its liability to corrosion and adhesion are not the chief objections to the safety valve: when under the control of reckless men, it may be, and there is abundant proof that it often is, loaded far beyond the highest estimated working pressure of the boiler. A boiler, moreover, may be burst by a force below its ordinary working pressure, when the tenacity of the metal has been diminished by heat; and in such a case, of course, the safety valve would have no tendency to relieve it. The evolution of steam, too, might be so sudden that the valve could not give it an exit sufficiently rapid to prevent explosion. The safety valve, then, though an indispensable appendage to the steam boiler, is liable to these sources of failure, and therefore cannot be implicitly relied upon as a means of safety. It is lacking in some of the most essential of the qualities which have been pointed out as requisite in an apparatus which should satisfy the demand for perfect protection.

The *fusible plates* required to be attached to every boiler, by the ordinance of the French government, are plugs of an alloy so compounded as to melt, and so give vent to the steam, at a temperature corresponding with the greatest pressure under which the boilers are allowed to work. To prevent their giving way as they approach the fusing point, they are covered by wire gratings or perforated metallic disks. The experiments upon these plates made by the Franklin Committee, show that when fusible alloys are subjected to heat and pressure at the same time, the more fusible portions are melted first, and forced out by the pressure to which they are subjected. The residuary mass is thus left with a fusing point much above that at which the alloy was calculated to melt. Every repetition of the fusing process under these circumstances was attended with a rise of the temperature required to produce the result. It is evident that the protection afforded by fusible plates, used in this way, diminishes in proportion as the necessity for it is increasing by the deterioration of the boiler from age and use. The liability to this action has been considered a sufficient reason for deciding that no efficient practical application of these alloys can be made while they continue to be subjected to pressure*.

To obviate this difficulty, Professor Bache devised the plan of enclosing the fusible metal in a tube inserted into the boiler, thus subjecting it to the action of temperature alone. The melting of the alloy in the bottom of this tube sets free a rod connected with an alarm apparatus, and if necessary with the safety valve. The same idea occurred about the same time, to Mr. C. Evans of Pittsburgh, Pennsylvania, whose safety guard is identical in principle with the device of Dr. Bache.

The *safety guard* of Mr. Evans consists of a tube inserted through the top of the boiler, with its bottom resting on one of the flues. A small quantity of fusible alloy is placed in the bottom of the tube, in which a spindle is inserted, so arranged as to be capable of turning only when the metal is in a state of fusion. On the upper end of this spindle is a small drum, around which a cord is wound. This cord passes over a pulley attached to

* General Report. p, 11.

the end of the lever of the safety valve, and has fastened to it the weight which keeps the valve down. The operation is simple; the alloy being melted, the spindle is, as it were, unsoldered, and allowed to turn; the cord is unwound from its drum; the weight falls on to a support prepared to receive it, and the safety valve is entirely relieved. The advantages of this plan are that it not only indicates danger, but relieves it, and that the spindle is self-adjusting. The only operation requiring the attention of the engineer is the re-winding of the cord, an operation which could not be neglected without stopping the engine. The apparatus, however, is as liable to be tampered with as the common safety valve; it is acted upon by temperature alone, and would not indicate a deficiency of water, unless such deficiency were occasioned or accompanied by a rise of temperature sufficient to melt the alloy. The range of temperature in fusible alloys, between perfect fluidity and perfect hardness, is an important consideration with reference to the comparative sluggishness of the apparatus in which they are employed. The property most desirable in alloys, used in the safety apparatus of engines, is of course a small range of temperature in changing from the liquid to the solid state, as the promptness of the apparatus depends upon this quality. The Franklin Committee found that, with reference to this range, those alloys should be preferred which contain the smallest quantities of lead; and, for the same reason, those containing the smallest proportions of bismuth.

The comparative sluggishness depends so much upon the particular composition of each alloy, that no satisfactory general conclusion can perhaps be drawn from an average result. Alloys compounded to melt at high temperatures (where, of course, the necessity for promptness is greatest) have fortunately a less extensive range between fluidity and hardness, than those intended to give way at low temperatures. The average result obtained by Professor Johnson from experiments on 140 specimens, makes this range 31·1 degrees Fahrenheit,† so that when a mass of such alloy has become perfectly fluid, it requires that number of degrees of heat to be abstracted before it becomes again perfectly hard. This whole difference, however, is not operative in practice in the case of Evans's apparatus; for it was found, by the Commission of 1843-44, that the average difference of temperature between fusing and setting is only about 7 or 8 degrees,* showing that the action of the weight upon the spindle causes it to turn before the alloy has become perfectly fluid, and that the alloy is sufficiently set to support the weight before it has become perfectly hard. Still a range of 7 or 8 degrees in a boiler, under a pressure of five or six atmospheres, would require the pressure to be diminished from two to two and a half atmospheres, after the action of the apparatus, before it would be again ready to act. This diminution would be attended with a loss of both water and heat. The range of temperature between the opening and closing of a common safety valve, in ordinary working order, was found, in the same research, to be about 5°, showing a difference in favour of the valve, of about 3°. The comparison, however, is not intended to be carried farther than this single point. The fusing point of the alloy does not change materially by the repetition of the melting process. On the whole, Mr. Evans's apparatus, when the alloy is properly prepared, the apparatus fairly used and not tampered with, is one upon which considerable reliance may be placed for the purpose which it professes to accomplish—the indication and relief of a dangerous elevation of temperature in the metal of the boiler.

(*To be continued.*)

* Report of Experiments, Franklin Institute, p. 38.

† Senate Document 405, 28th Congress, 1st Session.

* Senate Document 405, 28th Congress, 1st Session. Table on p. 24.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 27TH OF SEPTEMBER, 1849.

JOHN MACKINTOSH, Bedford-square, *For improvements in furnaces and machinery for obtaining power, and in regulating, measuring and registering the flow of fluids and liquids.* Patent dated March 24.

1. The improvements in "furnaces" consist in preventing the external air from passing to the fuel through the door and ash-pit; and in supplying it by any suitable blowing machine, through a small orifice cut for that purpose. The "expanded air" and products of combustion are thereby driven into a close chamber, fitted to the opposite end of the boiler, whence they escape, and are applied to the working of an engine, while the steam is applied to work a second engine.

The employment of this invention in steam vessels will, it is stated, render the use of chimneys unnecessary, as the air and products of combustion may be allowed to escape after the work is done, through openings, cut in the side of the vessel, near the line of floatation.

2. "For obtaining power," Mr. Mackintosh proposes to place a cistern, partially

filled with water, in the lower and central portion of a ship. A steam chest is placed in the cistern, and has two or more "trunks" connected to it, each divided into two equal portions by a flexible partition attached to the top and bottom of the two ends. The trunks are inclined, or curved, so that their free ends may be partially above the level of the water, and the attached ones entirely beneath it. When the apparatus is not in action the water flows into the lower divisions of the trunks and raises the flexible partitions to a level with it, but on steam being admitted to the trunks alternately from the steam chest, by means of valves constructed as described in a former specification (see vol. L., page 18), the water will be forcibly expelled, and the vessel, it is stated, be thereby propelled. The water re-enters the trunks through valves placed behind the partitions. Or,

3. A series of horizontal tubes are placed in the interior of the vessel, each having the one end connected to a steam chest, and the other opening into the surrounding water beneath the line of floatation. The tubes are constructed with lateral openings, which are fitted on the inside with flap valves, and admit air into the interior. Steam is then made to pass from the steam chest by means of the peculiar kind of valves before mentioned, which will, by its pressure, cause the flap valves to close the lateral openings and the air to be expelled into the water, whereby the vessel will be propelled. The outer ends of the tubes are contracted and furnished with flap valves, opening outwards, so as to prevent the inflow of water when the jet has ceased.

The patentee states, that the preceding arrangements may be applied, when suitably modified, to the propulsion of carriages.

4. To prevent the recoil of a gun after firing, it is proposed to fix to its muzzle a cylinder of much larger diameter than the gun itself, and closed at one end. The explosion of the powder will have the effect of creating a partial vacuum in the closed end of the cylinder, and the unbalanced pressure of the atmosphere against its outside will tend to prevent the recoil. The top portion of the end of the cylinder is made to open outwards, for the purpose of enabling the gunner to level the gun.—[A clever conceit, but not covered by any of the words of the title.]

5. To propel gun-boats, it is proposed to adapt a cylinder to the muzzle of the gun, and to attach a cone to it. Communication is established between the cylinder and the cone. When the gun is fired with powder only, the unbalanced pressure of the atmosphere will drive the gun forwards, and consequently the boat also. The gun is to be charged with a series of cartridges connected together by fuzees, so that the explosions may be made to take place at certain regular intervals of time successively.

6. A fourth mode of "obtaining power" is as follows:—Within a cylinder fitted with an outflow pipe, which contains a valve weighted to any desired pressure, is placed a second concentric cylinder, which is keyed on a hollow axis. Two or more channels are constructed in the second cylinder, and communicate by their inner ends with the axis, while their outer ends open into the space between the outside and inside peripheries of the two cylinders. The channels are curved about their centres, and arranged in pairs, something like the letter S. Flexible partitions are placed in the channels, so that, on steam being alternately admitted into their inside divisions through the hollow axis from the steam chest, the flexible partitions will be distended, and the fluid or vapour which was contained in the outside divisions of the channels will be driven into the outer cylinder.

7. For "regulating the flow of fluids," the patentee employs a tube, through which the fluid flows, and which contains two partitions placed at a certain distance apart, and parallel to each other. The partitions have openings cut in their centres, and a crank lever is suspended in the space between them. To one end of the lever is attached a spring valve, which slides over the outflow opening, so as to wholly or partially close it, while another valve piece is attached to the other end of the lever, and thereby suspended opposite to the inflow opening, so that the lever will be acted on by the inflow of the fluid, and will close the outflow opening in proportion to the pressure.

8. For "measuring" he uses a meter constructed of a flexible tube, closed at one end, and having a lateral opening. Above the tube is an axle, which carries three equidistant spindles, each having a conical roller free to revolve thereon. These rollers pass over the tube, and are so placed that when one rolls off the tube at one end, the succeeding one shall roll on at the other. And if the capacity of the tube between the two rollers be ascertained, the flow of fluid will be consequently measured and indicated by suitable registering apparatus actuated by the revolution of the axle.

Claims.—1. The mode of constructing furnaces in order that the steam may be applied to work one engine, and the expanded air, together with the products of combustion, to work a second one.

2. The various modes of obtaining power for propelling.

3. The arrangements for preventing the recoil of guns.

4. The methods of regulating, measuring, and registering the flow of fluids and liquids.

JOHN MASON, Rochdale, Lancashire, machine-maker; and GEORGE COLLIER, Barnsley, York, manager. *For certain improvements in machinery or apparatus for preparing and spinning cotton, and other fibrous materials; and also improvements in the preparation of yarns or threads, and in the machinery for weaving the same.* Patent dated March 26, 1849.

Claims.—1. The employment in lap machines of a presser-plate or rod, for the purpose of condensing the material before it is delivered to the lap roller.

2. Constructing the "dish" of Bodmer's patent feeder in wool-carding engines as a steam chest, in order that heat may be introduced therein, and communicated to the wool in the course of preparation, whether the feeding roller be also heated or not.

3. An arrangement and construction of apparatus for adjusting the carding rollers and clearers nearer to or farther from each other, and also the main-carding cylinder, as occasion may require.

4. Constructing the bend and casing in one piece.

5. Arranging the cards in roving and slubbing frames upon the doffing cylinder in a sinuous, undulating, zig-zag, or inclined line.

6. Constructing the bobbins in spinning machines with an interior tube.

7. Placing the spindles on one side of the machine only, and the flyers, which are actuated by toothed bevel gearing, between two rows of rails.

8. Placing an accelerating motion between the main driving pulley and the tin roller, whereby its diameter may be decreased, and the width of the throstle frame diminished.

9. An arrangement and combination of the dressing and warping apparatus; also of the sizing, drying, and warping apparatus for winding the yarn or thread on the swift or reel, either in spiral or parallel rings.

10. An arrangement and combination of the scouring, sizing, dressing, and warping apparatus, whereby the yarn or thread is warped upon the beam in sections; the beam being constructed with flanges or divisions for that purpose.

11. An apparatus for giving notice, ringing a bell, or stopping the machine by knocking the driving-band off the roller, when a thread breaks or fails.

12. Fixing the healds in frames.

13. Connecting the treadles to these frames or harness by toothed racks and segments.

14. A mode of diminishing the weight upon the warp beam, as its diameter decreases, by moving the fulcrum of a weighted lever.

15. A similar arrangement for letting off the warp at a uniform tension, and also for taking up the cloth.

16. Another like arrangement for subjecting the cloth to a uniform tension in combination with the taking-up motion.

17. Shedding the cloth in such a manner that the change of pattern may be effected while the shed is open, and the treadles pass from one full shed to another without any dwell.

18. Actuating the pick sticks in underpick looms by a lever on the back part of a crank suspended from the top.

19. A self-acting apparatus for raising the treadles.

20. Coating the peripheries of carding cylinders with gutta percha.

DAVID HENDERSON, London Works, Renfrew, engineer. *For improvements in the manufacture of metal castings.* Patent dated March 26, 1849.

These improvements relate chiefly to the moulding and casting of pipes, cylinders, and other articles of which any great number is required. The boxes or flasks in which the pipes are moulded consist of two parts, and the internal diameter is somewhat larger than the pipe to be formed, so that there may be left about two or three inches of sand between the pattern and the inner surface of the box. Where the two boxes join, they are each furnished with a lip projecting inward, leaving a space between the two lips of the same half of the box nearly the exact diameter of the pipe. The mould, which is a short piece of what is termed a half pattern, is put between the two lips, by which, together with the aid of a clamp, it is retained in its place until the sand has been rammed in between it and the back of the box. When this has been accomplished, the short piece of pattern is drawn further along the box, and another part of the sand mould completed, and so on, till the mould has been finished, when the core is put in in the usual manner, and the casting finished by pouring the metal into the mould. When the moulds are made of dry sand or loam instead of green sand, as has just been described, the same mould may be employed for more than one casting. After the metal of the first casting has set, it is taken out of the box, and the mould, if damaged, is repaired while yet in a hot state. A fresh core is then introduced, and the casting proceeded with as before. The flasks or boxes being made solid (instead of being composed of ribs as heretofore) are pierced with numerous small holes for the escape of the steam and gases.

The casting of pots, mouldings, ridges, &c., are proceeded with in nearly the same manner as the pipes.

Claims.—The method described of moulding and casting pipes, cylinders, ridges, and mouldings.

Alexander Parkes, Harborne, Stafford, chemist. *For improvements in the deposition and manufacture of certain metals and alloys of metals, and improved mode of heating and working certain metals and alloys of metals, and in the application of the same to various useful purposes.* Patent dated March 26, 1849.

Mr. Parkes' improvements consist—

1. In depositing on the surfaces of iron tubes, or any other articles of metal, copper, silver, tin, lead, and bismuth in successive layers, through the agency of electric currents. He states that he has found the articles of metal to be better protected by this system than by the old one of coating them with one metal only.

2. In forcing air or chlorine gas by means of a blowing machine upon the surface of copper, or the alloys of copper, in the refining furnace, for the purpose of facilitating the smelting process.

3. In forcing air, by means of a blowing machine, upon sulphuretted copper in the blast or reverberatory furnace, after the manner specified in a former patent granted to Mr. Parkes.

4. In the application, as a blowing machine to the two preceding purposes, of the apparatus ordinarily employed to exhaust gas from retorts.

5. In combining iron, silver, and nickel for casting with phosphorus, in the proportion of from two to ten, by dropping the phosphorus into the combined metals while in a state of fusion.

6. In coating metals, or alloys of metals, with a combination of other metals, or alloys of them, which melt at a lower temperature than the former.

7. In coating rollers which have been worn down by use with the phosphuretted metal.

8. In combining with copper or its alloys molybdenum, chromium, tungsten, and manganese, which are to be used in the form of acid oxide. The metals are plaeed in a crucible, covered with carbon, and a small quantity of phosphorus mixed with them.

9. The patentee proposes, lastly, to manufacture printing rollers, by coating cylinders of iron or other metals with copper. A solution of copper, in cyanide of potassium, at a temperature of 150° Fah., is employed for this purpose.

Stephen White, Victoria-place, Bury-new-road, Manchester, gas engineer. *For improvements in the manufacture of gases, and in the application thereof to the purposes of heating and consuming smoke; also improvements in furnaces for economizing heat, and in apparatus for the consumption of gas.* Patent dated March 26, 1849.

This invention relates principally to the construction and arrangement of apparatus for the production of what is termed water gas, and which was the subject of a former patent granted to Mr. White. This gas is composed of a combination of carburetted hydrogen gas with hydrogen gas and oxide of carbon gas—the result of the decomposition of water by contact with charcoal, coke, or anthracite coal, mixed with small particles of iron or lime, heated to a high temperature.

The apparatus first specified is constructed of a material capable of bearing the greatest heat that can be obtained (white red), and consists of two vertical retorts placed in an oven over a furnace. Inside each retort there is a flue which communicates at bottom with the furnace, and at top with the oven. The products of combustion ascend the flues, and pass into the oven, so that the retorts and their contents are heated both inside and outside. They are filled with small pieces of charcoal, coke, or anthracite coal, and thin plates of iron or pieces of thin iron wire, and their covers at top, by which these materials are introduced, luted and securely fastened down, so as to render them perfectly gas-tight. Water is caused to fall in a succession of drops, or in a small stream, into syphon pipes, which conduct it on to the top of the materials through which the gas thus generated descends to the bottom of the retorts, whence it escapes into horizontal retorts (also placed in the oven), and there meets and mingles with carburetted hydrogen gas; which is generated in the following manner: A quantity of resin and oil, or of tar or fat, or other substance rich in carbon and olefiant oil, is melted in a vessel, fixed on the top of the oven, and allowed to flow in a liquid state into the horizontal retorts, which are each divided into two or more compartments by horizontal partitions extending nearly to the end. These compartments are filled with copper or iron chains, or pieces of wire twisted into a spiral form, so as to offer a heated and partial resistance to the passage of the gas to the hydraulic main. When pit coal is employed instead of resin, as the hydrocarbon, it is placed in the horizontal retorts, and the employment of the other parts of this branch of the apparatus dispensed with, care being taken to allow sufficient passage for the gas resulting from the decomposition of water, to mix with the bicarburetted hydrogen gas produced by the distillation of coal.

The chains are to be occasionally taken

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Errata.—Page 125, for

$$2=(1+2)^n, \textit{ read } 2=(1+i)^n.$$

Also, for

$$n=\frac{\log 2}{m.\left(\log.\left(1+\frac{2}{m}\right)\right)}$$

read

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PLUMMER'S PATENT IMPROVEMENTS IN FLAX MACHINERY.

Fig. 2b.

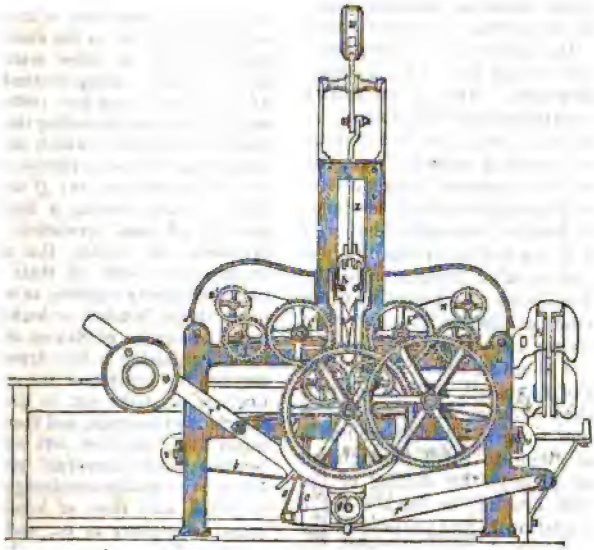
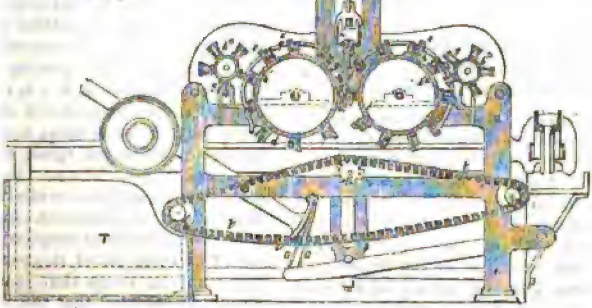


Fig. 6b.

Fig. 5b.

Fig. 7b.

Fig. 3b.



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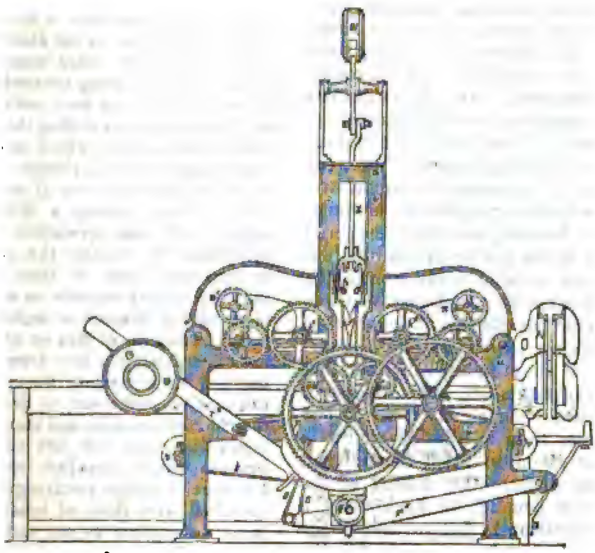
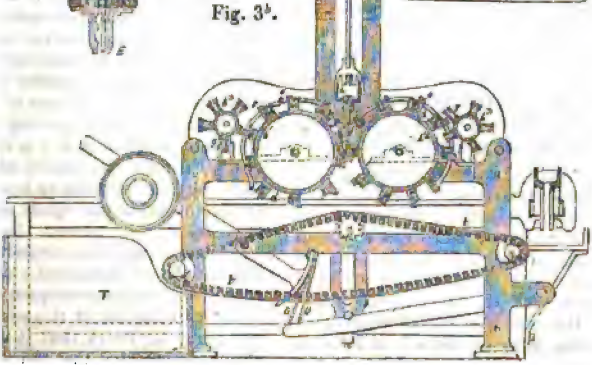


Fig. 6b.

Fig. 5b.

Fig. 7b.

Fig. 3b.



There are two revolving cylinders, $b^1 b^1$, mounted in a framework, *aa*, as in the machine before described, only that they are made in this case of greater length, in order to make room for the addition to their periferies of sets of rigid heckles, *c*, intermixed with the sets of elastic brushes, *cc* (in any way that may be deemed most advisable), as exemplified in the longitudinal section of one of these cylinders given separately in fig. 4^b. The cylinders are also made to revolve inwardly, or in opposite directions, and the

Fig. 2.

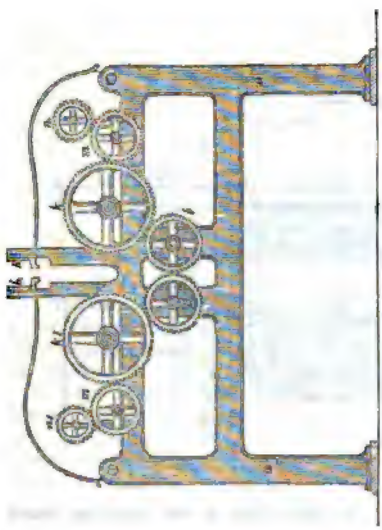


Fig. 3.

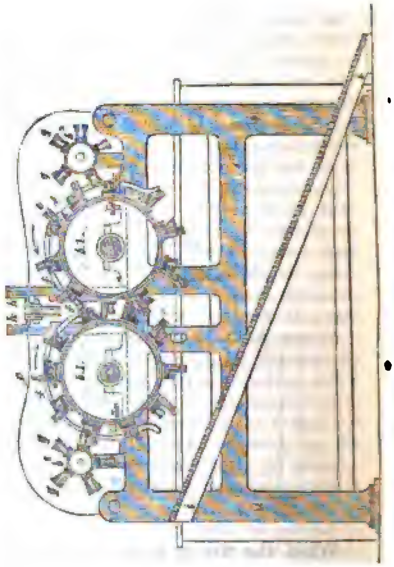


Fig. 1.

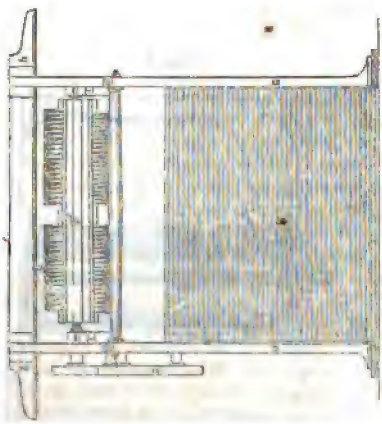
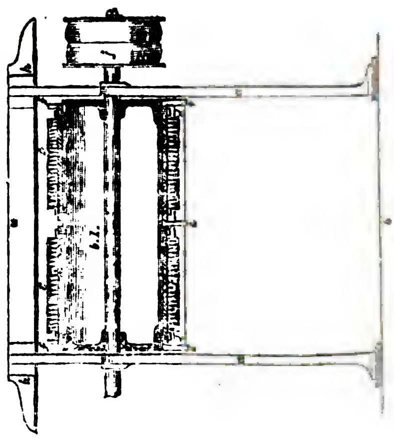


Fig. 4.



rows of brushes and heckles on the one cylinder are placed in an alternating order in regard to those of the other cylinder, both as before described, so that the streaks shall

have at one and the same time both a front and back stroke given to them (though not in the same plane). There are also loose stripping bars with guards, which, besides regulating the depth to which the heckles or brushes shall penetrate, doff the tow from the brushes and heckles; and two smaller cylinders, b^2 b^2, fitted with brushes for cleaning the working brushes and heckles, c and c^1. Rotation is given to the rotating parts of this machine in the same way as to the rotating parts of the one before described. But the holder is made to traverse or move forward in the trough by a combination of a bell-crank movement with the rising and falling motion of the trough, as afterwards described. A view of the sort of holder preferred for this machine is given separately, on an enlarged scale in fig. 5^b (a side elevation), fig. 6^b (a cross section), and fig. 7^b (a longitudinal section). It consists of two plates, No. 1 and No. 2, connected ransversely by a screw-bolt, S, and having flanges, AA, at their upper edges, by means of which they are supported in the trough (k). The plate No. 2 has two flanges, BB, one on each side, which come within the flanges, AA, of the plate No. 1, and thereby confine the streak of flax or other fibrous material at the edges. The inner face of the plate No. 2 is planed perfectly true, and covered with felt, cloth, or some other soft or yielding material; but the plate No. 1 is made on its inner face with flat beads (C), and flat grooves (D), in alternate order, so that the streak of flax or other material may be thereby the more firmly compressed and held between the plates, without being unduly crimped. At their under edges (E), the plates are chamfered off as shown, so as to admit of the holder coming close down upon or within the nip of the brushes or heckles affixed to the revolving cylinders. It will be observed that, by this mode of construction, the pins or studs ordinarily made use of, to confine and regulate the outer edges of, the streaks are wholly dispensed with, and a greater breadth of area thereby obtained whereon to spread the streaks, while at the same time the holder is narrowed, and rendered lighter and more easy to work.

The mechanism for lifting the trough is shown in fig. 2^b, and consists of a combination of pinions (k^3 k^3), wheels (m n), cam (p), straps (o), pulleys (g), and levers (r s), such as is ordinarily used in heckling machines, and well known. When the trough is raised, it pushes up a rod, z, which is connected to the long arm of a bell-crank, y, mounted on a standard affixed to the top of the framework, a, when a weight, W, which is attached to the opposite end of that long arm, falls over, and causes the short arm of the bell-crank to pull in a rod, z^1, which draws forward a finger-bar, x (of the ordinary construction), to an extent sufficient to advance the holder the breadth of one set of heckles or brushes. The tow and shive and dirt doffed from the heckles and brushes are, in this case, received upon an endless chain of bars, t t (instead of the inclined grating used in the machine first described), which bars extend the whole length of the machine under the heckles and brushes, and are connected together by two side bands, t^2 t^2. The chain of bars revolves round two friction pulleys, v v, and takes into two pinions, u u (one on each side), by means of which pinions rotation is given to the chain from the same first mover by which the other parts of the machine are put in motion. The shive or dirt falls through between the bars on to the floor, while the tow is carried forwards on the top of the bars, and delivered into the trough, T^1. To separate the tow doffed from each set of heckles or brushes, from that doffed from the others, the space between the top of the endless chain of bars and the heckle and brush cylinders is divided by partitions, a^a a^a, fig. 1^b, into as many compartments as there are sets of heckles or brushes, and the receiving trough, T^1, is also divided into a corresponding number of compartments.

(*To be continued.*)

THE LINES OF THE "CANOPUS."

Sir,—Many thanks to your correspondent "Z," for his remarks on Art., p. 177, relative to the *Canopus*. He has the advantage of me, as I never saw the *Canopus* in dock, but I have seen her lines, and believe her midship section not to be very different from what it is represented to be in fig. 4—at least from the water-line to 15 feet below it, which is all that affects my data. And though it were not, my argument would not be affected. Some of her sections before the middle are such as are described by "Z."

According to the assumption in the text, s s is 15 feet below the load water-line, but for the same reason that r' r', fig. 8, (*Vanguard*) is not taken as giving an estimate of the stability, but n' n', which is a mean point between s and B'; so a mean point between s and B in the *Canopus* should be taken as giving an estimate of her stability. It is to the breadth there that "*a shade less*" is meant to apply, and not to the breadth at s s, which no doubt would be much less; but it would be *very* much less

in *Vanguard* at $s' s'$, fig. 8, and still less if the curved floor, complained of, were straight. Fig. 4 and 9 are intended to be similar.

The positions of $a' b' a'' b''$, and in fig. 5 and 6, are respectively 10 feet, 7ft. 6 in., and 4 ft. 6 in. below the load water-line under the circumstances stated. In these vessels, however, the positions would vary with the direction of the sea as regards the course of the vessel; and their positions in other vessels would depend upon their breadth, and the direction of the sea, together with its height and length.

But I speak of the *Canopus* family and *Vanguard* family, being more anxious to establish the truth of the principles than the absolute fact, as regards the particular ships—the latter indeed could only be obtained from a knowledge of all the sections of each. The midship sections, however, and sufficient to argue upon, as to the relative value of the respective principles of construction displayed in each.

While I do not know any forms so bad, in this respect, as those designed by Sir William Symonds, I do not mean to say that there are not others very bad. Amongst these I would class the *Gibraltar*, the *Raleigh*, the *Inconstant*, and some few French, of which it is needless to speak; these vessels cannot fail to roll deeply in a seaway.

I did not select the *Canopus* as having the best form in the part alluded to, but as being of the same class as the *Vanguard*. Some of the old English and American forms are better in this point than her, but there would have been a difficulty in finding one of their class in the *Vanguard* family to compare them with.

The points sought to be established are—that in proportion as the stability is obtained by great breadth, and a V shape of midship section, there will be less comparative stability and ease of motion in a seaway and strong winds—those circumstances under which they are most necessary.

The greater the breadth, the greater must be the perpendicular depth of side below the load water-line to retain stability and the greatest comparative ease in a seaway.

The desirableness as regards ease, and also expense, of deriving part of the stability from ballast.

The desirableness of centralizing the weights (literally at least), and the difficulty of doing so from the weight of the sides and guns being greater than that of the moveable weights, and as this difficulty increases with the breadth (all other things being equal) the ease will *decrease* with the breadth in the respective classes.

Very truly yours, Sir,

E——.

ON THE APPORTIONMENT OF THE COST OF EARTH-WORK IN FORMING EXCAVATIONS, EMBANKMENTS, ETC. BY T. SMITH, ESQ., C. E.

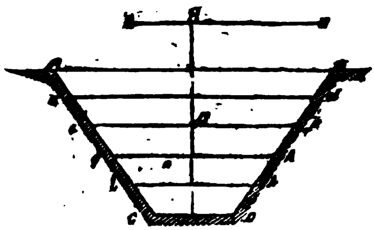
Sir,—The investigations on the removal of earth by Monge, and Dupin, although characterized by a refinement of thought apparently but ill-adapted to the usually rough details of actual practice, are, nevertheless, interspersed with many valuable hints, which, with a little modification may be turned to important uses by the practical man. In the application of the theory as developed, it is true, that an ultimate atom, or an indefinitely minute particle of the mass, may seem to be but a dim representative of the cubic foot or yard of practice; yet an analogy really exists between them, which, when used within certain limits, leads to results that may be regarded as practically correct in our every-day operations, and readily applied to some of the useful purposes of real life.

To those who may enter upon the study of this interesting subject, I think it will appear at an early stage of their progress, that by adopting the method of *moments* as taught in elementary works upon mechanics, the problem becomes considerably simplified and divested of much of that abstract character which not unusually shrouds the reasonings of eminent analysts. It is not my intention, however, in this paper to enter upon any discussion of the general theory; my object being merely to indicate its application to a particular case, namely, the *apportionment of the cost* of work in the various parts of the same section of an excavation, embankment, &c.

If P pence be the *average* price per cubic unit fixed for the excavation and removal of the material in a cutting, the cross section of which is represented by fig. 1, it is clear, assuming the labour of

getting and filling to be the same, that the upper layers ought necessarily to cost less than those which occupy a lower position in the section; but the exact part of P, which is the correct price of a cubic unit, wherever situated in the section, subject to the condition that the whole cost shall not exceed P pence × by the sum of the units in the section, is not so obviously apparent.

Fig. 1.



If the mass ABCD (fig. 1) be supposed divided into solid units, and each unit *separately* raised to the level of any plane, as AB, the theory of moments would enable us to demonstrate that the aggregate of the work done in making these partial removals is equal to the work which would be expended in raising the entire mass at *one lift* through the length GH, the distance of its centre of gravity from the plane AB. It follows therefore, that in apportioning the cost of removal of each cubic unit of the section with reference to the average price P, the distance GH of the centre of gravity of the mass from some given plane AB, becomes an essential element.

The trapezoidal forms of section are those which most commonly enter into earth cuttings and fillings; let therefore ABCD (fig. 1) be a trapezoid, having its sides AB, CD parallel; let $CD = a$, $AB = b$, DL or CE (the shortest distance of AB from CD) $= h$, and $GH = \delta$. The distance GH of the centre of gravity of the section from the plane AB, is then

$$\delta = \frac{h}{3} \cdot \frac{2a+b}{a+b} \dots\dots\dots\dots (1.)$$

If we suppose the ratio of the side slopes to be given, *i.e.*

$$\frac{BL}{DL} = r_1, \text{ and } \frac{AE}{CE} = r_2, \text{ then}$$

$$b = (r_1 + r_2)\,h + a.$$

Substituting this value of b in (1) we have therefore

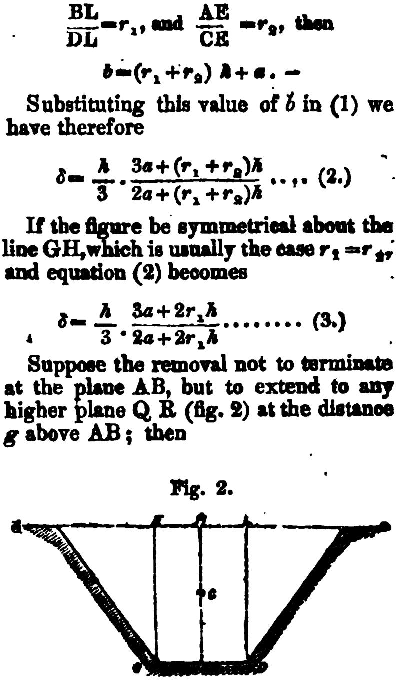
$$\delta = \frac{h}{3} \cdot \frac{3a + (r_1 + r_2)h}{2a + (r_1 + r_2)h} \dots\dots (2.)$$

If the figure be symmetrical about the line GH, which is usually the case $r_1 = r_2$, and equation (2) becomes

$$\delta = \frac{h}{3} \cdot \frac{3a + 2r_1 h}{2a + 2r_1 h} \dots\dots\dots (3.)$$

Suppose the removal not to terminate at the plane AB, but to extend to any higher plane Q R (fig. 2) at the distance g above AB; then

Fig. 2.



$$\delta = \frac{3ah + (r_1 + r_2)h_2 + 3q.\{2a + (r_1 + r_2)h\}}{6a + (r_1 + r_2) \cdot 3h} \dots\dots (4.)$$

If in the foregoing equations we suppose the quantities a, b, r_1, r_2, to vary or vanish successively, it is obvious we shall produce such a corresponding change in the figure as will adapt it to all the varieties of forms more or less used as the transverse sections of earth-works.

Equation (4) gives a general determination of the distance δ, and as the aggregate work which would be expended in raising each cubic unit of the mass separately to the plane AB is equal to that necessary to raise the centre of gravity of the whole mass through the same distance, it follows that the cost in the one case should equal that in the other. If therefore P_1 be the *average* price per cubic unit, and P_2 the price of raising a cubic unit through one unit in height, then

$$P_2 = \frac{P_1}{\delta} \dots\dots\dots\dots\dots\dots (5),$$

in which last equation is to be substituted the proper value of δ as determined by equation (4), or any of its modifications.

Having thus assigned the cost of a solid unit over one unit in length with reference to the average price P_1, it is now necessary to consider the *lengths of the paths* over which each unit of the mass must pass during the removal of the whole. In doing this it will be unnecessary for my present purpose to enter upon the discussion as to the best lengths of relays, or the most economical distribution of inclines—the vertical distance through which an unit is raised being the essential object in view.

Suppose the section (fig. 2) divided into thin strata or partial masses by the lines *ab*, *cd*, *ef*, &c., parallel to AB, each of these layers being an unit in height; these partial solids are in reality trapezoids, but their height being small in relation to their other dimensions, their centres of gravity may therefore, *for practical purposes*, be supposed to be at *half their height*. Upon this supposition, if the layer AB *cd* be raised upon the plane AB, its centre of gravity will have passed over half an unit in length; if the layer *cd ef* be similarly raised, its centre of gravity will have passed over $(1+\frac{1}{2})$ unit in length; the next layer over $(2+\frac{1}{2})$ units in length; the next over $(3+\frac{1}{2})$ units, &c. If n_1 represent the number of layers into which the section of the cutting is divided, the units in length over which their centres of gravity must pass in being raised to the level AB, will therefore be represented respectively by the terms of the arithmetical progression,

$$\frac{1}{2}+\frac{3}{2}+\frac{5}{2}+\frac{7}{2}+\ldots\ \frac{2n_1-1}{2};$$

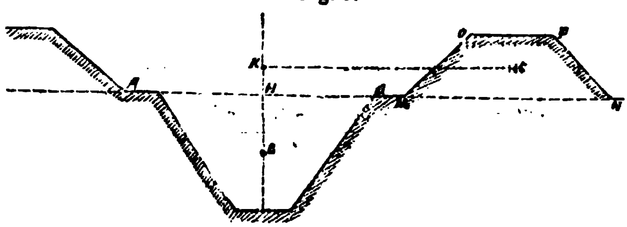
and the price of each of these layers with reference to the average price P_1, will be represented (*eq.* 5) by the following terms:

$$\frac{P_1}{2\delta}\cdot\left\{1+3+5+7+\ldots\ 2n_1-1\right\}\ldots(6.)$$

If the lift of the material terminate at the plane AB, the expression (6) is then complete, and the respective terms give the entire rate; but it most commonly happens in practice that the lift extends to some distance HK $=q$ (Fig. 3) above AB. The figure of the embankment (or spoil heap) MNOP has no necessary connection with that of the cutting from which the material is taken; but whatever figure it may be made to assume, the distance (q) of the centre of gravity from the plane AB may be previously determined, and therefore the price P_2, equation (5). The complete expression for the price of each layer in such cases is, therefore,

$$\left.\begin{array}{l} 1^\circ\ldots\ \dfrac{P_1}{2\delta}\cdot\left\{1+3+5+7+\ldots 2n_1-1\right\}+ \\ 2^\circ\ldots\ \dfrac{P_2}{2\delta}\left\{1+3+5+7+\ldots 2n_2-1\right\}\cdot- \end{array}\right\}\ldots\ldots\ (7.)$$

Fig. 3.



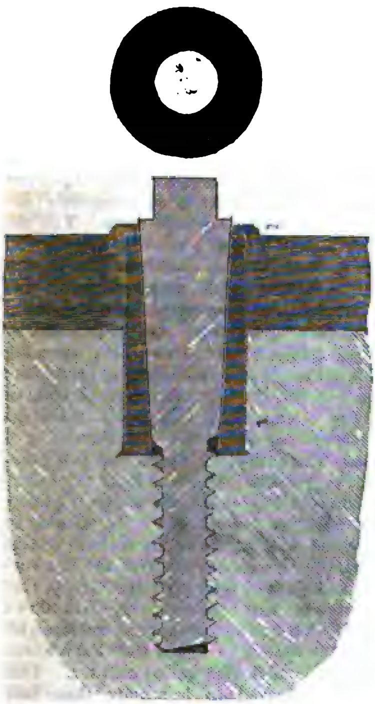
in which, 1° applies to the section of the cutting, and 2° to that of the embankment or spoil heap; n_1 and n_2 representing respectively the number of layers into which the excavation and embankment are divided, the unit of measure being the same in both.

The degree of accuracy which may be attained in the practical application of the foregoing formulæ to figures whose parallel sections are not equal, but varying according to some given law, is dependent upon the magnitude of the unit of measure adopted. If the unit be taken *one inch* in length, the results will be more accurate than when taken *one foot*, and this again will give results more accurate than if the unit were taken *one yard* in length. The smaller the unit is taken, the greater will be

the number of layers into which the given section is divided; the greater also will be the number of terms in formula (7), and consequently the greater will be the approximation to absolute truth; to which, by diminishing the unit of measure, we may approach *as near as we please*. The illustration of this part of the subject by practical examples, I must, however, postpone to a future opportunity.

(*To be continued.*)

DESIGN FOR A HOLLOW SCREW. BY SIR SAMUEL BENTHAM.



The accompanying engraving is of a screw for ship work from amongst the drawings left by Sir Samuel Bentham. He employed hollow screws with great advantage in his experimental vessels (*Mechanics' Magazine*, No. 1306, pages 171, 2), and he devised others of a variety of forms according to the parts of ships for which they were intended. The screw now given is from a drawing, to which no description is annexed. The screw, however, appears evidently to have been intended for use in a structure in which wood and metal were combined. A great enlargement at the head of the screw is given by means of pieces analogous to his coques of wood. This metal coque having a kind of flaunch to take a hold in the timber or plank, could not, it is evident, be inserted whole; it is therefore divided into two, so that the halves might be successively introduced and forced into their places previously to the insertion of the screw. The drawing indicates that this fastening was intended for the construction of "ribs or beams of metal to the planking," so that "no hole need be pierced through either the bottom or the sides" of the vessel. From the coloring of the drawings it would appear that the screw was intended to be of wrought iron, and the coques of cast.

THE "ORKNEY ROTARY ENGINE."

Sir,—In your Magazine of the 22nd September, there is a circumstance mentioned calculated to be highly injurious to our interests; namely, that the Orkney Rotary Engine "is thrown open to the world." It is open to the world to manufacture by license only.

You will excuse my saying that I think you have dealt unnecessarily harsh with Mr. Harford and myself; I should hope, from not knowing the facts of the case. My claim is certainly what you term it—"a paper one," that of giving Mr. Galloway his first idea, in a drawing, of the present Orkney engine. I do not deny Mr. Galloway's talent, or his share in working the thing up to a certain point, where he left us in the midst of difficulties, which he either could not or would not overcome; and it has been only by constant exertion for the last eighteen months on the part of Mr. Harford, Mr. Bulman, and myself, that the engine has been brought to its present working condition. Mr. Galloway, in parting with the whole of his interest, wrote to my partner, not only calling the engine "Fitzmaurice's Engine," but expressing his opinion that it would never come to anything; now that it is successful, he would have it called by his own name. There are too many witnesses of these facts for me to care for any contradiction from Mr. Galloway. If, in my answer to him in the *Times*, I abstained from mentioning these matters, it is because I did not wish to press hard upon one

whose fortunes, from some cause or another, are not so good as they might have been; but when I am told by Mr. Galloway, or his friends, that I and Mr. Harford are "sailing under false colours," and our honest and severe exertions in a great cause are run down, I feel it is time to defend myself, and let the public know the whole truth.

I am, Sir, yours, &c.,
W. FITZMAURICE.

Down-place, Maidenhead, Oct. 2, 1849.

[We may freely grant all that Captain Fitzmaurice says to be true (which we doubt not it is), and still retain our opinion that it was very wrong in the Captain and his friends to put forth "the Orkney Engine" as something entirely new, when it was, in truth, only Mr. Galloway's, in an improved state. Captain F. claims, indeed, to have given Mr. G. "the first idea;" but the fact of Mr. G. being the patentee—the *sworn* inventor, so to speak, of the engine—precludes the public from regarding any other person in that light. Mr. G. observes, in a letter to the *Mining Journal*, that when they are going so far north as the Orkneys for a name, they might have as well called it "the *Mull* of Galloway." A good joke this, but conveying also, according to Captain Fitzmaurice's present statement, a greater share of truth than Mr. Galloway probably intended.—ED. M. M.]

OXIDATION OF RAILS IN AND OUT OF USE.

An interesting paper on this subject, by Mr. Mallet, was read at the late Birmingham Meeting of the British Association. The conclusions at which Mr. Mallet has arrived are the following:—The top surface of a railway bar in use is constantly preserved in a state of perfect cleanliness, freedom from oxidation and polish; while the remainder of the bar is rough-coated, originally with black oxide, and soon after with red rust (peroxide and basic salts). Not only is every metal electro-positive to its own oxides, but the polished portion of a mass of metal partially polished and partially rough is primarily corroded on the rough portion. Hence a railway bar while in use is constantly preserved from rusting by the presence of its polished top surface. Such polished surface has no existence on the rail out of use. The upper surface of the rail in use is rapidly condensed and hardened by the rolling of the traffic over it; and all other circumstances being the same, the rate of corrosion of any iron depends upon its density, and is less in proportion as this is rendered greater by mechanical means. As every metal is positive to its own oxides, the adherent coat of rust upon iron, while it remains, powerfully promotes the corrosion of the metal beneath, and this in a greater degree in proportion as the rust adherent is of greater antiquity. It has been shown that the rust produced by air and water, which at first contains but little per-oxide, continues to change slowly, and becoming more and more per-oxidized becomes more and more electro-negative to its own base. Now, the rust upon a railway bar out of use continues always to adhere to it, and thus to promote and accelerate its corrosion; while the rust formed upon a railway bar in use is perpetually shaken off by vibration, and thus this source of increased chemical action removed. To recapitulate; railway bars forming part of a long line, whether in or out of use, corrode less for equal surfaces than a short piece of the same iron similarly exposed. Rails in use do corrode less than those out of use. The difference is constantly decreasing with the lapse of time. The absolute amount of corrosion is a source of destruction of the rail greatly inferior to that due to traffic. It is highly probable that the electrical and magnetic forces developed in the rails by terrestrial magnetism and by rolling traffic, re-act in some way upon the chemical forces concerned in their corrosion; and that, therefore, the direction of lines of railway in azimuth is not wholly indifferent as respects the question of the durability of rails. The author concludes with two practical suggestions, deducible from the information obtained:—1st. Of whatever quality iron rails are rolled, that they should be subjected prior to use to an uniform course of hammer-hardening all over the top surface and sides of the rails; and, 2ndly, that all railway bars before being laid down should, after having been gauged and straightened, be heated to about 400° Fahrenheit, and then coated with boiled coal tar. This has been proved to last more than four years, as a coating perfectly impervious to corrosive action, while constantly exposed to traffic.

LAW OF PATENTS.—EXTRACTS FROM THE MINUTES OF EVIDENCE TAKEN BY THE COMMISSIONERS ON THE SIGNET AND PRIVY SEAL OFFICES.

(Continued from page 235.)

William Carpmael, Esq., Examined.

Has been engaged in the business of a patent agent for twenty-seven years. Thinks a lawyer is the fittest person to conduct such investigations as those which

occur on oppositions to patents. Sees no objection to the patent dating from the day of the first application, if you put other fences round, so that no wrong shall come of it. Thinks a patent should not be too low in cost. In proportion to the number of patents granted the validity of any one is comparatively decreased by reason of the greater difficulty in making a specification. The great difficulty in all patents is drawing the specification, because the person who draws a specification ought to read all previous ones upon the same subject, consequently he must be paid more when there are a large number of previous patents, and the probability of making a good specification is decreased. Is of opinion that to make patents very cheap you would destroy in substance the grant, and would overrun the country with a lot of claimants without any real benefit either to the public or to the patentees. Considers it perfectly immaterial whether the costs are levied in one sum, as, for example, by a stamp duty, or by successive fees.

Thinks a great advantage accrues to the public in Scotland or in Ireland from the specifications being deposited in Edinburgh and Dublin; and that it would be desirable to increase the number of places where specifications could be read.

Supposing a patent could be obtained at the same cost for the three kingdoms as for England alone, sees no objection to that, except that the officers in the different places would be losers.

Is not aware of any real practical advantage accruing, either to Scotland or to Ireland, from having a separate issue of patents to persons resident in Dublin and Edinburgh. The inventors of Ireland are exceedingly few. The inventors of Scotland are becoming more and more as manufactures are more and more introduced there; and has no doubt it would be the case in Ireland, if manufactures were introduced more there.

Has very great doubt as to making patents much cheaper. Will not say that 300*l.* ought to be paid, but thinks that a considerable sum ought to be paid. Is clear upon this, that it would have the effect of damaging patent property in all respects if patents were very cheap. Cannot conceive any law that should interfere with the originators of trifling inventions from applying for such grants. Does not think the amount should be such as to prevent the manufacturer of what may be called a trifle from having a patent for it, because a multiplicity of trifles makes a very important manufacture,—for instance, a button, a needle, or a pin. Those are all trifles, but some of our richest patents have been taken out for such matters. Thinks, nevertheless, that it is very desirable not to grant patents for such a small sum as that everybody would be running to the Patent-office. The point is this. Supposing a larger number of patents, by reason of their cheapness, are taken out, for, we will say, spinning, and then a very brilliant invention is made by any individual appertaining to spinning. In order that he should make that patent a good one, he ought to read, either by himself or those that assist him, every patent relating to spinning; and here he will find one piece that is similar to his, and in another patent he will find another piece that is similar to his, and in another he will find another piece that is similar to his, and so on, till at last the difficulties multiply in proportion to the number of patents granted upon this subject, and he would be a very clever man indeed who would make a substantive patent by reason of the immense number of rocks that he has to steer between. This would not be objectionable if each of the previous patents was for a valuable invention; but such would in practice never be the case, and in many instances, probably not one of them, standing alone, of any value to the public or patentee, but accumulated together by the new invention, a very brilliant result may be produced. In such cases great injury will be done to the real and useful inventor. By giving a man with little money a cheap patent, you are not doing for him a good thing. If you give it to a poor or a rich person, with only an imaginary invention, you ruin him by encouraging him to spend money upon a useless article. The cost of a patent, compared with the cost of bringing out a new invention, whether good or bad, is very small. Does not think any advantage would arise from diminishing the fees upon the three patents to a less amount than about 100*l.* If a patentee could have an opportunity of either having it for England, for Ireland, or for Scotland alone, and he also had the power, if he chose, to take it for the three at once, it would be very desirable to reduce the total amount of the three, but not below 100*l.* Does not think it would be desirable to reduce the English patent much below 100*l.* Thinks if a patent were granted for the three kingdoms, the patentee might reasonably pay more than 100*l.*, say 150*l.*

Does not consider the French system as to patents preferable to ours. They grant you a patent for a small sum of money, and you are required to pay an annuity from year to year as long as it lasts, and that brings upon you all the objection witness has to cheap patents, and does, in fact, give the inventor no real benefit except the ima-

ginary benefit that a poor man may get a patent. Can only say, speaking from his own experience, that a patent to a poor man is generally a curse.

Supposing the proceeding for obtaining a patent for a new invention were of this nature; that upon an application to the Crown having been transmitted by the Secretary of State to the Attorney-General, and a favourable report having been received after due examination and notice given to interested parties, the patent should be made out in perhaps a more concise form in the office of the Secretary of State, and should then be transferred to the Great Seal, does not see the slightest objection to it in the world, provided they retained the power of inquiry at the Great Seal which they now have. Upon that supposition, the stages at the Patent Bill-office, and Signet-office, and Privy Seal-office would be omitted. Sees no practical inconvenience that could result from the suppression of these stages.

Has heard it urged that the Attorney-General is an exceedingly improper man to decide patent matters, and that judges and juries are exceedingly bad tribunals; but should be sorry to see the day when scientific men should be made judges in place of witnesses.

William Newton, Esq., Examined.

Has practised as a patent agent about thirty years.

Considers a newly-appointed Attorney or Solicitor-General is scarcely competent to decide all questions of mechanical construction; but in the course of a very short time he becomes sufficiently acquainted with such matters. Thinks it desirable that the law-officers of the Crown should be the referees upon occasions of opposition; because, as they ultimately reach the Bench, and in many instances the Chancellorship, it is very desirable that they should have some previous experience in patent matters, so as to understand those things well before acting judicially upon existing interests. Thinks that the way in which oppositions are conducted is certainly for the benefit of the public. If there is anything like an attempt made by one party to take an invention from another, the Attorney or Solicitor-General, when apprized of the fact, calls for affidavits from the contending parties, and investigates the matter very promptly. Is of opinion that the Attorney-General rarely requires any additional scientific advice besides that which he has now access to. The agents generally understand the subject thoroughly. He can, if he pleases, call in (which he does sometimes in matters of chemistry) professional advisers. For scientific matters, the Attorney-General relies in general upon the information that he obtains from the patent agents. Sometimes he possesses a pretty good knowledge himself. But the Committee will understand that the discussions are only on matters of comparison between this thing and that thing; whether they are alike or not; not what are the powers of the machines. That he has nothing to do with. But for matters of fact involved in an invention, he relies upon the information he obtains from patent agents; and does not see how he can avoid doing so. Matters of fact are reduced into a very small compass. The Crown is never answerable for the absolute validity of a patent. The thing may be old, and the agent ought to know whether it is or not. Considers the practice with respect to caveats very satisfactory, and one of the best things about the whole system; it prevents frequently very serious robberies of inventions. Does not think it would be desirable to give a more general notice than is given under the present system to the public, because in many cases it would only create opposition from parties who might get hold of the inventor's idea the moment the subject was mentioned. Sometimes an invention is of that character that the mere mention of its object discloses the nature of the invention. Thinks it would be highly objectionable that a public notice should be given of an intention to apply for a particular patent. It has always been considered objectionable to allow any person to inspect the caveat-books, to know what caveats there were. Thinks the law should be so far altered as to make the patent date from the period of the petition. But neither in that case would he approve of a public notice of a patent being applied for. The ultimate granting of the patent, though it might take date from the petition, would, in case of an opposition, be dependent upon the hearing before the Attorney or Solicitor-General, and if too much publicity were given to the application, it might call forth a successful opposition. That would be very likely to occur; as, for instance, witness has often discovered the nature of an invention from the mere wording of a title.

Thinks it important to preserve the second stage of opposition at the Bill, also the right of opposing at the Great Seal..

Has long thought that one patent ought to extend over the whole empire; but has understood that there were great difficulties in the way. If those difficulties do exist, then considers the better plan would be, after granting the English patent, to allow the parties to go to Scotland and Ireland, if they pleased, at a small extra charge—say

20*l.*, for extending the patent to each of these kingdoms; but in that case, would have a specification enrolled in each kingdom, as a necessary matter of reference.

Does not know that there would be any objection to patents being taken out for the three kingdoms at one place, instead of having three distinct patents; except that as some inventions will not apply to Scotland and Ireland, it would be unfair to a petitioning party, who required only protection for England, to be taxed at a greater rate than at present for a seemingly wider jurisdiction of his rights. In that case also, the being compelled to enrol three specifications (one for each of the three capitals) would be a serious item of unnecessary expense, if stamps and enrolment fees were required as at present.

Thinks it desirable that the present fees upon patents should be reduced, say, the English to 60*l.*, and the other two patents to 20*l.* each; thus making the cost 100*l.*, instead of exceeding 300*l.*, as at present, exclusively of the cost of agency.

Does not think it would be satisfactory to make the procuring of patents too cheap. Some people entertain the notion that if we were smothered with patents, they would lose all their effect, and especially that they would be always in courts of law on questions of infringement. There may be something in that; still, thinks patents ought to be cheaper than they are. It frequently happens that a man who has an ingenious invention which he cannot find means to secure, is obliged to sacrifice half his interest to some party who finds the money for securing it.

(*To be continued.*)

REPORT OF THE COMMISSIONER OF PATENTS OF THE UNITED STATES, ON EXPLOSIONS OF STEAM-BOILERS, DECEMBER 30, 1848.

(Continued from page 306.)

The *Expansion Guard* of Mr. Wright,* makes use of the different expansibility of metals as an indication of the temperature of the boiler, and a means of relieving the safety valve, where the elevation of temperature is such as to indicate a dangerous increase of pressure. A brass tube, closed at its inner end, is inserted into the boiler head, immediately over one of the flues. In this tube, but lying loosely, and attached only to its inner end, is a rod of iron, projecting on the outside a short distance beyond the head of the boiler. When the brass tube is heated, it expands, and of course projects further into the boiler, carrying with it the less expansible iron rod. The outer end of this rod moves an index which shows the temperature of the metals, and is attached to a catch which operates to relieve the safety valve, as soon as a dangerous pressure on the boiler is indicated by the temperature attained.

With regard to all self-acting apparatus intended to relieve the safety-valve, it ought to be borne in mind that their operation is attended with a consequence which might, under some circumstances, prove a very serious disadvantage. It is, that the boat may be deserted by its power at the moment of greatest need. In going through such a passage as Hell Gate, for instance, such a desertion, even if but momentary, might be attended with fatal results. This view would seem to justify a preference for apparatus intended to give an alarm, over those which operate spontaneously to relieve the safety-valve. Where engineers are careful, there can be little doubt of the propriety of such a preference.

The third class of safety apparatus includes such as act by deficiency of water combined with the pressure, to relieve from the dangerous tension of steam.

The *double-acting safety-valve* of Mr. Raub* differs from the ordinary safety-valve in having a float and additional lever attached to it, so arranged that the fall of the float below the proper water line opens first a small valve, to sound an alarm, and, if the fall continues, raises the main safety-valve. The small valve opens downwards; and it was found that, in boilers using high steam the pressure was sufficient to keep it closed, thus reducing the apparatus to the common safety-valve, "to which," in the opinion of the Board to whom it was submitted, "it is in no respect superior."†

The *hydrostatic safety apparatus* of Mr. Duff,‡ is a valve with a large hollow head, from which a tube passes down below the ordinary level of the water in the boiler, to the lowest permissible water line. So long as the mouth of the tube remains below the water, the valve head is kept full of water, which thus forms the greater part of the load; but when the water in the boiler falls below the mouth of the tube, that in the valve head is, of course, discharged into the boiler, thus relieving the valve of its load. The time taken to discharge the water from the valve head renders the operation of this apparatus sluggish: and as it is liable to be brought into action by any sudden change of level in the water, though such change may be unattended with danger, it is not

* Patented February 24, 1845.

* Patented November 8, 1836.
† Senate Document, 405.
‡ Patented July, 1843.

considered applicable to the boilers of steam boats.

The *interior safety-valve* of Mr. Easton* is placed, as its name imports, entirely within the boiler, and is not liable to be tampered with by the engineer while the boat is in motion. The valve opens downwards, and is kept closed by a lever of the first order. There is a float attached, the fall of which raises the long arm of the lever and opens the valve. A rod (called a *feeler*) passing through the top of the boiler immediately over the valve, enables the engineer to open but not to close it. The valve was found upon experiment to open promptly, the mean difference between the opening and closing pressure being only 5·32 pounds. This apparatus, however, does not indicate whether the escape of steam is due to the fall of the water in the boiler, or to a pressure beyond its load. This may be ascertained, however, by raising another valve, when, if the opening of the interior valve be caused by excessive pressure, it will at once close, but if from deficiency of water, it will continue to blow. Mr. Easton's apparatus is favourably spoken of by the Board, by whom it was examined. It was tried by them, however, under favourable circumstances, and with pure water. Its efficiency on the muddy waters of the west, this office has no means of ascertaining.

The several forms of apparatus for supplying water, without indicating either temperature or pressure, constitute the fourth and last class.

The instrument for this purpose, ordinarily employed, is the common force pump worked by the engine. Its liability to obstruction, and the fact that it operates only while the engine is in motion, constitute the chief objections to it. Many boats employ subsidiary pumping engines which supply water during the stoppage of the main engine.

The self-acting pumping apparatus of Mr. Barnum† is brought into action by a float, the fall of which below the due water line opens a valve which supplies steam to a subsidiary pumping engine. A deficiency of water sets the pump in action, without the agency of the engineer, and a full supply stops it. An ingenious double valve has been applied to it, which prevents the pressure of the steam from counteracting the weight of the float, thus rendering it applicable to high as well as low pressure boilers. The trials made by the Board of Examiners with this apparatus were, in general, highly satisfactory.

Having thus glanced at a few of the more prominent mechanical devices for the prevention of explosions, some of which claim to be important improvements upon the safety apparatus of the steam engine, the undersigned does not feel called upon to express any opinion as to their relative merits, still less to point out any particular apparatus as best calculated to meet the wants of the public. Even if any one of these contrivances could be singled out with certainty as the best existing plan for obviating danger of explosion, it is not believed that its employment ought to be recommended as the subject of compulsory legislation by Congress. These plans are all before the public, who have a vital interest in selecting the one best calculated to secure their lives and property. Nothing can add to the force of motives drawn from the love of money and the desire of self-preservation. If the apparatus selected for Government protection were not the best, the law would be evaded, or openly disobeyed; if it were the best, and yet not a perfect safeguard, its protection would operate as a check upon the ingenuity of inventors by taking away its strongest stimulus. The source of danger, in the opinion of the undersigned, is to be looked for elsewhere than in the imperfection of the engine or its appendages, and the legislative remedy ought to be applied in a different quarter.

The legal remedies for explosions, then, are the next subject to be considered. These are either preventive or penal. The preventive measures are such as relate to the qualities of the engine, and the qualifications of those who are to inspect or manage it. The penal provisions are those which provide for actions, civil or criminal, against the parties through whose fault injury has been committed.

Before submitting any suggestions or recommendations, "with reference to further legislation by Congress for the prevention of the explosion of steam-boilers," it is deemed proper to lay before the Senate the objections which are entertained by practical men to the existing laws, together with the modifications of them which they propose.

The laws now in force are those of July 7, 1838, and March 3, 1843. The third section of the law of 1838 gives to the "district judge of the United States within whose district any ports of entry or delivery may be," the appointment of inspectors to make inspection of the hulls, boilers, and machinery of "vessels propelled in whole or in part by steam."

(*To be continued.*)

* Patented 1842.
† Patented July, 1844.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 5TH OF OCTOBER.

GEORGE HENRY MANTON, of Dover-street, Piccadilly, gun maker; and JOSIAH HARRINGTON, of Regent-circus. *For improvements in priming, and in apparatus for discharging fire-arms.* Patent dated March 28, 1849.

A grooved reservoir is made in the front part of the stock of the gun, to receive the percussion cap. A transversal axis is placed beneath the end of the receptacle for the ramrod, and at right angles to it. This axis carries a small lever, the long arm of which is furnished with a friction roller, which is made to press against the end of the ramrod by the action of a spring on the short arm. The axis is moreover fitted with an arm, having a pin on the inside of the free end, which takes into a slotted piece which slides up and down in a curved groove, just in front of the hammer. A pair of spring jaws is attached to the top of the sliding-pin by a pin-joint, and carries a spring piece, the top of which is opposite to the back of the jaws. When the ramrod is pushed quite to the end of its receptacle, it depresses the long arm of the small lever, and, consequently, the arm fixed on the outer end of the axis and connected to the slotted sliding-piece. This arm then presses upon a projection from a vertical sliding-piece, resting at bottom on a spring, and withdraws it from over the opening of the percussion-cap reservoir.

At the same time, and by the same action, the end of the jaws, which are opened by a projecting-piece, is brought opposite the mouth of the reservoir. On the gun being held in a vertical position, the cap will drop into the space between the ends of the jaws: but, on the ramrod being withdrawn, resistance to the action of the spring upon the short arm of the small lever will be removed, and the axis caused to make a partial revolution; which will have the effect, through the intervention of the outside arm and slotted sliding-piece, of moving the jaws upward and bringing the cap, which they carry, over the nipple of the gun, when the back spring will come into action and place the cap on the nipple. The vertical sliding-piece will, by the ascent of the outside arm, be free to move over the mouth of the reservoir, and prevent any of the caps falling out. The return of the ramrod to its place, after charging, will produce the same results as first described, and, of course, cause the apparatus to retire out of the way from between the hammer and the cap upon the nipple.

Claim.—1. The combination and arrangement of apparatus for placing the priming, or percussion-cap, in a position for firing, and of causing the apparatus to retire after charging by the movement of the ramrod.

CHARLES GREEN, of Birmingham, patent brass tube manufacturer; and JAMES NEWMAN, of Birmingham, manufacturer. *For improvements in the manufacture of railway wheels.* Patent dated March 28, 1849.*

A bar of iron is bent into a circle, and the edges welded together. It is then placed in a bed die, constructed so as to receive the periphery and flange of the wheel, and subjected to the action of a top die which is hollowed out into the shape of a dome, whereby the upper or plain end of the hoop will be bent inwards; after which it is passed through a series of dies, each having its dome of a lesser curve than the preceding, until the last assumes the appearance of a level surface, and forms the flat centre of the wheel — the hole to receive the nave. The nave is then punched, but leaving the edges ragged in order that the two surfaces may more readily and effectually combine together. The nave is composed of a cylinder, in two pieces, which is placed in the central hole of the wheel, and over a mandril fixed in the bed die. It is then subjected to a series of top dies for the purpose of welding it to the disc, and of giving it the required form; care being taken to place in the first instance a moveable ring round it, between the disc and bed die, for the purpose of confining it within certain limits.

Claim.—The mode of manufacturing the peripheries, centres, and naves of railway wheels.

PIERRE RENE GUERIN, of Havre. *For improvements in steering ships and other vessels.* Patent dated March 28, 1849.

These improvements consist in dispensing with the use of tiller-ropes and tackle, and substituting in their stead a right and left-hand screw, cut on the axis of the steering-wheel, which screw works inside two nuts respectively. These nuts are placed upon the screws, one in front and one behind the rudder-post, to which they are connected by the intervention of jointed levers, so that as the wheel revolves, the nuts will traverse to and fro upon the screws on the axis and cause the rudder-head to make a partial revolution. Several modifications are specified, together with various arrangements for the employment of toothed or bevelled

* For the specification of the former patent of these parties for the manufacture of railway wheels, by welding tyres on the discs, see vol. L, p. 391.

gearing, either alone or in combination with eccentrics, instead of the ordinary tackle, for the purpose of communicating motion from the axis of the steering-wheel to the cross-head of the rudder-post, and thence to the rudder itself.

It is proposed to sling the rudder by means of bolts placed in grooves cut in the top and bottom of the box—the two portions of which are respectively made fast to the rudder-post and to the deck; or by a combination of horizontal and vertical friction rollers, which are also placed in a box suitably constructed to receive them.

No claims are made in this specification.

William Buckwell, of the Artificial Granite Works, Battersea, Surrey, civil engineer. *For improvements in compressing or solidifying fuel or other materials.* Patent dated March 28, 1849.

This invention consists in solidifying and compressing fuel, by percussion, into blocks suitable for stowage. The fuel (coke for example) when reduced to a granulated state and moistened with water, or by the humidity of the atmosphere, is placed in a stout cast iron cylinder, faced on the inside with wrought iron or steel, and subjected to the action of a steam hammer of 3 tons weight, and making 50 strokes a minute. It is stated that it has been found advisable not to force the block of fuel out of the cylinder immediately after the stroke. And for this purpose a piece of iron is, in the first instance, placed in the cylinder and allowed to rest upon a prop, which works up and down like a piston in a steam cylinder, and is securely supported against the bottom of the iron at the extremity of the up-stroke, during the moment of percussion. The descent of the steam hammer drives out the iron block, and forces the powdered fuel, which was placed above, into its place, whereby it will be compressed and solidified. The iron block is then laid aside, and the compressed fuel separated from that in powder, which is above, by the interposition of an iron plate. The blocks of compressed fuel are subsequently dried by exposure to the atmosphere, or to heated air. When the granulated fuel is too dry or too moist, which would destroy the effect of impact, it will soon be made manifest by the escape of a quantity of powder or by the exudation of moisture through the side; but the experience of the workman will soon enable him to arrive at a knowledge of the degree of moisture which is requisite to insure the successful working of the invention.

Claim.—1. Compressing and solidifying fuel in moulds by percussion.

James Fletcher, of Salford, Lancaster, manager; and Thomas Fuller, of Salford, aforesaid, machinist and tool-maker. *For certain improvements in machinery, tools, or apparatus for turning, boring, planing, cutting metal, and other materials.* Patent dated March 28, 1849.

These improvements, which would be unintelligible without illustrative engravings, relate,

1. To a double self-acting planing and surfacing lathe.

2. To an apparatus for boring steam cylinders of locomotive engines when in their places.

3. To an apparatus for planing the surfaces of valves when in their places.

4. To an apparatus for re-surfacing the sealing of D and other valves.

5. To the employment in slotting machines of an adjustable slide, eccentric elliptical wheel, and apparatus for inclining the table to the angle that may be required.

The claims refer to these different improvements as described in the specification, and shown in the drawings which accompany it.

John Britten, of Birmingham, manufacturer. *For certain improvements in the means, apparatus, and appliances for cooking, preserving, preparing, and storing drinks and articles of food, and in preparing materials for constructing the same; also in constructing vertical roasting-jacks and chains for the same, applicable to other chains, parts of which improvements are applicable to other similar purposes.* Patent dated March 28, 1849.

Mr. Britten's improvements are as follows:—

1. Constructing an inside mantel-piece in a kitchen range, with doors extending to the hobs, so as to form a kind of bonnet, for the purpose of preventing the chimney from smoking.

2. Heating ovens by combining the bottom draft with the current of heated air.

3. The employment of an additional damper, in order that the top draft may be cut off without closing the bottom one.

4. Heating ovens, by causing hot air to pass under the bottoms of, and to circulate through them, whereby the use of the hollow crown is dispensed with.

5. Heating ovens by air, which is heated by being made to pass through the hollow cheeks of the range which partially project into the oven.

6. Taking the air employed to heat the hot plate from a point nearer to the burning fuel than has hitherto been usual.

7. Fixing a small lever upon the inside end of the handle of pendant oven doors, which takes into a notch in the bolt, so that when the handle is pushed towards the door,

the bolt is shot and the oven closed, and when it is lifted up the bolt is drawn and the door allowed to fall. The handle may be made to serve as a support to the door.

8. Regulating the supply of water to kitchen, steam, and other boilers by a ball-cock, which is in the form of a hollow semi-hemisphere, and is placed with the mouth downwards, so that when there is no steam given off, it falls down, and allows water to flow in; but when steam is generated, the water is thereby displaced, whereby it rises to the surface, and shuts off the supply.

9. Burning the fire-clay slabs employed in the construction of stoves and ovens, by the application of hot air, and causing the hot air which escapes from one kiln, when the work is done, to heat the air supplied to feed the combustion of the fuel in the next kiln.

10. Preserving corn or other grain by constructing the apartments in which it is stored with perforated floors, through which air is forced from air-tight vessels, placed underneath, and consequently made to circulate through the grain.

11. Constructing the works of vertical tubular jacks upon the bottom plate, which is dropped into the outer case, and retained in position by means of a set screw.

12. Manufacturing jack chains by twisting iron rods or wire round the spit. Each turn of the rod or wire is then divided at the broad part of the spit, and the links formed by means of a die or stamp.

Claims.—1. The employment of an additional damper.

2. The mode of regulating the supply of water to boilers.

3. The burning of fire-clay slabs by the application of hot air, and heating the feed air of one kiln by the exhaust air of the preceding one.

4. The mode of constructing jack chains, and its application to the manufacture of other chains.

James Lawrence, the Elder, of Colnbrook, Middlesex, brewer. *For an improvement or improvements in brewing worts for ale, porter, and other liquors, and in storing ale, porter, and other liquors.* March 28, 1849.

1. The improvements in brewing worts consist in the employment of a vertical or horizontal refrigerator for the purpose of cooling them. The vertical refrigerator is constructed in the form of a cistern, the sides of which are of wood or metal, and which has on each side, but separated from it, a series of small chambers communicating in pairs, and having each an air hole at the top, which may be plugged up when required. A number of thin horizontal copper tubes, about three-quarters of an inch in diameter, are supported in the sides of the cistern, and establish communication between the corresponding chambers on either side of it. Cold water is pumped in through a supply pipe in the bottom, and allowed to flow out at top. Wort is supplied to the top chamber of one series, whence it flows through the tubes into the top chamber of the other series, and drops into the one beneath. It then returns through the tube to the second chamber of the first series, and so on, flowing backwards and forwards through the tubes, which are cooled by the passage of water amongst them, until it reaches the bottom, where it is received in suitable receptacles. The tubes are made to have a slight fall to facilitate the passage of the wort through them, and doors are constructed in the sides of the chambers to allow of their being cleansed when required. The difference between the horizontal refrigerator and that just described is so trifling as not to require description, with the exception, perhaps, of the cistern, which contains a number of partitions attached to either side thereof, alternating and reaching nearly to the opposite one, so that the spaces will also alternate from side to side, and consequently cause the water to flow along the entire length of the copper tubes. The water flowing in one direction and the wort in another, it follows that as the temperature of the latter decreases it will encounter a colder stream of water than at the beginning. The patentee states that with either of these apparatuses he has been enabled to reduce boiling wort to 52° Fahr., in much less time than it can be reduced to 100° Fahr. by the present system of cooling in open pans.

2. The improvements in storing ale, porter, and other liquors, consist in placing a vessel, or bag of India rubber, or some other impermeable material, filled with water, upon the top of the vat, and immersing the lower part of it in the contents of the vat. If the water is changed once in 24 hours, the contents of the vat will keep cool, during the summer months, for a very considerable time.

Claims.—1. The improvement or improvements in brewing worts for ale, porter, and other liquors.

2. The improvement in storing ale, porter, and other liquors.

George Thomson, of Camden-road, cabinet-maker; and James Elms, of the New-road, gentleman. *For improvements in machinery for cutting and tying up fire-wood.* Patent dated March 28, 1849.

The patentees state that the wood employed for fire-wood is imported in blocks about eighteen inches long, having a sectional superficies of three square inches; and that it has hitherto been customary to saw them into three pieces, and afterwards

to split them up by hand into suitable sizes. The object of this invention is to substitute in a great measure mechanical for manual labour.

1. A drum or wheel, to the periphery of which steel cutters are bolted at a convenient distance from each other, is made to revolve by means of any prime mover. In front is a vertical standard, or chopping-block, the top of which is faced with steel, and slopes upwards in a right line with the centre of the drum. The blocks, which have been previously sawn, as is usual, by the ordinary sawing machines, are fed into a trough by hand upon an endless band, and thereby brought upon the inclined steel top of the cutting-block, at right angles to the cutters, and ready to be operated upon by them, care being taken to place the wood with the grain running vertically. Slips of wood six inches long, three wide, and half-an-inch deep, are split off, and drop on to an endless band, which conveys them into any suitable receptacle. The two endless bands are driven, through the intervention of suitable gearing, from the axis of the cutter-wheel. These pieces of wood are then gathered up by an attendant, and subjected to the action of a second machine, whereby they are split into smaller sizes fit for domestic purposes.

2. In order to obviate the use of a second machine, it is proposed to combine a portion of a circular saw with each cutter, so that they may make two cuts at right angles to each other.

3. The tying up in bundles is effected by a machine which consists of a top and bed-plate, with semicircular cells in each, arranged side by side, and corresponding to one another. The twine employed in securing the bundles is led from a reel at one end of the machine through hollow standards, and made fast to a pin at the other. The top is kept separated a short distance from the bed-plate by means of springs placed between them, and a portion of twine is pulled down to the bottom of the cell nearest the end where it is made fast, and there held by the finger, or by a pin, while the attendant places the sticks in the cell, and so on until they are all filled. He screws down the top plate to compress the pieces tightly together, cuts the string above each bundle, and ties them up; after which he unscrews the machine, removes the bundles, and recommences the operation.

4. Or, instead of the preceding apparatus, the patentees propose to employ a number of conical cylinders, to which sticks of wood are supplied through a hopper, in any convenient manner. A number of plungers are caused to act in the cylinders, and at each stroke to drive the pieces of wood rather more than half out of the contracted opening, when they are tied together by string or wire. The succeeding lots of sticks, which are driven forwards by the next stroke of the plungers, drive the tied-up bundles out of the conical cylinders on to an endless band, by which they are conveyed into suitable receptacles, whence they are removed and stored up ready for sale.

Claims.—1. The combination of cutters with the periphery of a drum or wheel for cutting firewood, together with suitable means for feeding the blocks thereto.

2. Combining saws and cutters with a drum for cutting fire-wood, so as to make two cuts at right angles to each other.

3. The mode of tying up bundles of fire-wood for sale.

4. The system of tying up wood by successively forcing it through conical cylinders, and tying or otherwise securing it while held at the greatest degree of pressure.

WILLIAM BECKETT, of Northwich, Cheshire, draper, and SAMUEL POWELL, of Witton, in the same county, foreman. *For certain improvements in the manufacture, making, or construction of certain articles of wearing apparel.* Patent dated March 28, 1849.

This invention has for its object the production, by known machinery, of cloth or other fabrics having both faces alike, or of different colours, quality, or texture; and also its application to the making of articles of apparel which are reversible at pleasure, and may be worn with either face outside, as may be desired.

1. The cloth is manufactured in the following manner:—For example, when it is desired to produce a fabric black on one side and blue on the other, the threads are arranged in the loom half of one colour and half of the other, each single thread of one colour alternating with a thread of the other colour. The warp is flushed at the edges four picks, and all the threads are bound up by the same shoot of the weft. When it is desired to produce a fabric (say) red on one side, and yellow, green, and brown upon the other, the threads are placed in the loom one half red and the other half of the three colours, and arranged in bands of six threads, each thread alternating with a red one. The weaving is conducted as in the preceding case. The modifications which must be made when it is desired to vary the pattern or style of the faces, will, it is stated, readily suggest themselves to the mind of any intelligent and experienced workman.

2. The patentee then describes a mode of making up the cloths into coats, waistcoats, and (*proh pudor!*) trousers, to be turned inside out and worn in that style by the owners, if they think fit; but this part of the specification is so encumbered with the

technical terms of the craft, that we must be excused from entering upon it. As far as we can judge, the garments when made up, would be most unsightly.

Claims.—1. The sole manufacture, make, or use of cloth, or other fabrics having, possessing, or showing two faces in one piece of different qualities, colours, or texture.

2. The application of such cloth or fabric to the manufacture of certain articles of wearing apparel, which are reversible, and may be worn with either side outermost, at pleasure.

HENRY HOWARD, of Railway-place, Fenchurch-street, London. *For certain improvements in the manufacture of glass, also in the construction of furnaces for melting and fining the same.* Patent dated March 28, 1849.

This invention consists in placing the descending flues between or behind the pots, and in contracting the furnace so as to maintain the flame on a level with them, and by these arrangements cause the heat to encircle and impinge against the pots, thereby effecting a uniformity of temperature and facilitating the melting process. The descending flues are represented as being placed in the four corners of the chamber appropriated to the reception of the pots, which are placed between them and the furnace. The patentee shows the application of his invention to a three and five-pot furnace; and also a double furnace arrangement, with a number of holes for feeding in the fuel, and "teazer holes" to permit of access to the pots.

2. It is proposed to place a thin sheet of platina above the furnace, supported in a suitable manner, in order to prevent the "droppings" falling from the crown into the refining pots.

3. The annealing furnace is constructed with the flues in the centre, on a level with the bottom, and with holes in the top, for the purpose of cooling down the metal and admitting light when the contents are to be removed.

Claims.—1. The peculiar construction of furnace for melting and casting glass, in which the flame is made to encircle and impinge directly against the sides of the pots, effecting thereby uniformity of heat and an improved quality of material.

2. In the portability; of the construction of furnaces for melting glass, with one or more working holes.

3. The adaptation of a sheet of platina to the crown of melting and refining furnaces, to prevent the droppings falling into the pots.

4. The peculiar form and construction of an annealing furnace with flues in the centre near the bottom, and holes in the top for allowing the heat to escape and admitting light when emptying it of its contents.

OSBORNE REYNOLDS, of Dedham, Essex, clerk. *For certain improvements in railways.* Patent dated March 28, 1849.

1. Mr. Reynolds' improvements have for their object; firstly, to diminish the risk of fracture of the chairs on which the rails of railways are laid. This he effects by constructing them of a compound of metals of greater strength and durability, and at the same time of much less weight than those materials heretofore employed for the purpose. His improved chairs are made of cast iron with ribs or knuckles, or other strengthening pieces of wrought iron incorporated more or less therein in the process of casting. The chair may be of any approved form, and the wrought iron pieces may also be of any forms most likely to accomplish the object in view. Two several exemplifications of this system of construction are given, and illustrated by drawings. In one, the wrought iron pieces are wholly imbedded in the mass of cast iron. In the other, there are pieces of wrought iron also wholly imbedded in the cast iron, but in addition a thin plate of wrought iron is inserted transversely, which is only partly covered with cast iron, part being left exposed to view. A chair of this description is stated to be well adapted for the joints of rails where great strength is particularly desirable, and where the interposition of such thin plates between the abutting ends of two rails is of no consequence. The pieces of wrought iron are directed to be thoroughly cleansed from rust, or tinned, or prepared with borax or sal-ammoniac, or other suitable material, before the cast iron is poured over them.

2. The patentee next describes an improved mode of constructing the keys or wedges used for fastening rails in the chairs, whereby their ordinary tendency to become loose after they have been for some time in use, is much if not altogether counteracted, and they are prevented from falling out under any circumstances. A recess is formed in the outer face of the key, and a layer of vulcanised caoutchouc (or other suitable elastic substance) is inserted at the back or bottom of that recess. Then, there is a block which fits loosely into the recess, and bears against the vulcanised caoutchouc (to which it may for convenience sake be cemented, but so as not to interfere materially with the elastic action of the caoutchouc). A detent or catch is raised on the fore end of this block. When first inserted in the chair, the pressure of the side of the chair on this projecting catch of the block, forces that block inwards upon the vulcanised caoutchouc, till the key is driven so far that the

catch passes free of the side of the chair, when the elastic spring of the caoutchouc immediately throws out the block behind the back of the chair, and thus not only makes the key fast and tight, but effectually prevents its retroceding or loosening under the severest jars or concussions. Instead of using one detent or projecting piece only, several such detents or projecting pieces may be employed in combination with corresponding projections on the face of the part against which the key is to be pressed when in its place; that is to say, projections to take into the hollow spaces between the detents. Keys of this sort will be found useful for other purposes besides railways.

2. Mr. Reynolds describes, thirdly, an improved mode of constructing splint-pieces and applying them to strengthening the joints of rails. It consists chiefly in making them of wrought and cast iron, the one imbedded in the other, as before described, with a facing of vulcanised caoutchouc; and in fastening the rails and splints by means of the same chair.

Claims.—1. I claim the construction of the chairs used for supporting the rails of railways, partly of cast iron and partly of wrought iron, more or less, incorporated or imbedded in the cast iron, as before exemplified and described.

2. I claim the making of the keys for railway chairs with elastic detents or latches, as before described. And

3. I claim the making of the splints used for strengthening the joints of rails of a combination of vulcanised caoutchouc, or other suitable elastic material, with cast or wrought iron, as before described, and also the method of fastening rails and splints by means of one and the same chair.

Thomas Harrison, of Liverpool, merchant. *For certain improvements in the construction of baking ovens, and also certain machinery for working or using the same.* Patent dated March 28, 1849.

Mr. Harrison describes and claims—

1. The constructing of baking ovens in tiers one above the other, having each either one or two doors, and containing each revolving or reciprocating bottoms, worked from the outside; and,

2. A mode of heating of baking ovens by the circulation of hot air throughout and around the same.

We shall give in an early Number a full description of these improvements, with engravings.

Alfred Vincent Newton, of Chancery-lane. *For improvements in separating and assorting solid materials or substances of different specific gravities.* Patent dated April 2, 1849.

Claims.—1. Subjecting the ore to the grinding or crushing action of several pairs of rollers, each pair being further asunder, and revolving at a greater velocity than the preceding one.

2. A mode of assorting the lumps of ore according to their sizes, in order that the pieces which do not require to be ground by the first pair of rollers, may pass to the second, and so on throughout the series.

3. A certain method of drying the ore preparatory to the grinding process, and between that and the screening process.

4. An arrangement of apparatus for screening the ore, and separating it into parcels of equal, or nearly equal-sized particles.

5. The subjecting the ore, in masses of equal or nearly equal-sized particles, in combination with the grinding, drying, and screening processes, to a current of air when falling by gravity, which separates it into parcels according to the specific gravity and value of the various particles.

6. The use of shoots to conduct the different particles of pulverized and dried ore, assorted according to the sizes of the particles, into chambers, where they are separated according to their specific gravities into different bins.

Francois Vouillon, of Princes-street, Hanover-square, manufacturer. *For improvements in making hats, caps, and bonnets.* Patent dated March 28, 1849.

These improvements relate to the manufacture of hats, caps, and bonnets of felt, leather, or other similar suitable material; and have for their object to supersede the present mode of stretching the material over a block by the aid of the fingers. The piece of felt, after it has been soaked in water for some time, is stretched over a brim-piece having a central hollow, and securely held there by means of a strip of elastic metal, which is made to encircle the edge of the brim-piece, with the felt in between, and has its two ends connected by a tangential screw, whereby they are drawn closer together, and the hold consequently tightened. The felt is then placed on the top of a brass or copper cylinder, which is furnished at bottom with a steam supply-pipe, and with an outlet for the water of condensation to escape by. Above the mouth of the steam supply-pipe is a horizontal disc for spreading the steam as it enters the cylinder. The block, which is of the shape desired to be given to the article, is attached to the bottom of a screw-rod, exactly over the central opening of the brim-piece: this rod passes through a female screw in the top of a standard, and carries a hand wheel at top. Steam is admitted to the material, and when it is sufficiently softened, the block is forced down upon it

through the central opening of the brim-piece. In order to prevent the separation of the block-shape and brim-piece, on their removal from the cylinder, a clamp is employed, which grips, by its two ends, the under side of the brim-piece, and at the same time presses down upon the top of the block throughout its entire length. All the parts of the apparatus which come in contact with the felt should be of brass, copper, galvanized iron, or other metal not liable to rust, in order to prevent injury to the manufactured article.

Claim.—Stretching felt, or other material of which hats, caps, or bonnets are to be made, on a brim-piece, and causing the block to pass through the central opening thereof, so as to force or stretch the material upon it, and thereby form a shape, according to the block, from which hats, caps, and bonnets may be made as required.

WILLIAM M'BRIDE, Jun., of Sligo, Ireland, but now of Havre, France, merchant. *For improvements in the apparatus and process for converting salt water into fresh water, and in oxygenating water.* Patent dated April 2, 1849.

The patentee, who has disclaimed the words, "and in oxygenating water," states that his invention consists in condensing the steam of salt water by a current of cold air. For this purpose, he employs a vessel filled with water of a lower temperature than the surrounding atmosphere, and containing a zig-zag tube, which is placed above a reservoir for receiving the condensed steam. The tube is supported in the upper part of the opposite sides of the vessel; one end is connected to an exhausting machine, and the other opens just in front of, and a short distance from the steam supply pipe, whence it descends to the bottom, which it passes through, and opens into the reservoir beneath. The vessel is furnished with an air escape pipe at top, and the reservoir with a cock for drawing off the condensed steam as may be required. The exhausting apparatus is an ordinary blowing machine, the action of which is reversed in respect to the tube, with an accelerating motion between the axis of the winch handle and the axis of the fan. The axis of the large driving pulley is supported in the bottom of a rod, which slides in a slotted piece, and passing through the upper part of the machine, is screwed at top, and furnished with a nut, whereby the friction of the driving strap may be regulated as occasion may require. When the machine is put in action by manual labour and steam made to flow from a boiler through the supply pipe, the latter will be drawn into the zig-zag tube, together with a current of cold air, and condensed.

Claim.—Condensing the steam or vapour of heated sea water, brine, or other salt water, by a current of cold air, which gathers it into a condenser by means of an exhausting or other blowing machine.

WILLIAM NORTON, of Lascelles-hall, Lepton, York, fancy-cloth manufacturer, *For certain improvements in the production of figured fabrics.* Patent dated March 28, 1849.

This invention consists in manufacturing pile fabrics in a manner similar to cotton velvet, and printing the pattern upon the surface of the pile, instead of printing the yarn, as has hitherto been usual. The pile is to be cut after printing. For the production of light goods, cross weaving is to be used; and for that purpose, the healds employed therein are to be substituted for those ordinarily in use, which is the only alteration that need be made. For stout goods, cross and plain weaving are to be employed together with one or more weft threads.

In order to produce a terry fabric similar to tapestry, one or more warp surface threads are passed through the same dent together with the ground warp thread. Stationary cords or wires are placed alongside the surface threads, and supported at the end near to the warp beam, while they rest upon the cloth at the other end. The arrangement for supporting the ground warp threads is the same as is constantly practised: while as regards the surface threads, each one is led through a heald in the first row, then through the doup heald supported by a heald in the second row. The stationary wire passes between the first and second heald. When the first heald descends (carrying down with it the doup heald), a shed is formed and the shoot made. It is then lifted up, and the second heald descends on the other side of the wire (carrying with it also the doup heald), whereby the thread will be crossed over the wire, the shed formed, the shoot made, and the loop tied. The loops are guided in the direction of the warp threads by the stationary wires against the edge of a cutter, suitably supported above the cloth, and between the slay and cloth beam.

Claims.—1. Producing pile-cut figured fabrics by the combination of weaving, printing the pile surface, and cutting the loops which have been produced from the weft or shoot threads.

2. Holding or securing the loops to the ground warp by cross weaving.

3. The mode of making terry fabrics, similar to tapestry, by the employment of stationary wires or cords, over which surface warp threads are crossed.

4. The application of cutters connected to the ends of the wires, to divide the loops.

5. The use of stationary cords or cutters to guide the loops or terries to the cutters.

WILLIAM HARTLEY, of Bury, Lancashire, engineer. *For certain improvements in steam-engines.* Patent, dated March 28, 1849.

Claims.—1. Working the steam valves of steam engines, having Cornish equilibrium ór ordinary disc valves, by means of oscillating cams working on a compound tappet-shaft independently of the ordinary tappet-shaft.

2. Working the steam valves of steam engines, having Cornish equilibrium or disc valves, by means of levers and a compound tappet on the fly-wheel shaft, or on another but concentric shaft, with a variable internal guide, having two lifts for cutting off and supplying the steam.

3. Working the steam valves of steam-engines, having Cornish equilibrium or disc valves, by means of two distinct sets of levers in combination with the compound tappet.

4. Working the D valves independently of the slide valves, so that they may move in the same or in opposite directions.

5. Admitting steam to the cylinder above the valves, and exhausting it through valves placed beneath them.

6. Working the D valves by means of a compound tappet on the axle of the fly-wheel shaft, or on an independent but concentric shaft, with three lifts, for admitting, cutting off, and exhausting the steam, with a variable internal guide.

7. Working D valves by two distinct sets of levers, in combination with the compound tappet.

8. A mode of connecting the variable motion with the governor.

JAMES THOMAS WILSON, of Glasgow. *For improvements in the manufacture of sulphuric acid and alum.* Patent dated March 28, 1849.

This invention consists in employing a glass chamber, instead of a leaden one, in the manufacture of sulphuric acid. The chamber is to be constructed of sheets or panes of glass, of a thickness indicated by one square foot weighing 16 oz., and of any convenient length and breadth, which are supported in a suitable framework of yellow pine, free from knots. The bars have rebates cut in them to receive the panes, and are protected from the action of acid and heat by fillets of glass, which are cemented to their inside surface, and secured thereto by glass pegs or screws. The joints between the panes themselves and between them and the fillets, are ground so that they may fit closely together, and are, moreover, rendered perfectly air-tight by a luting being brushed over them. The cements and lutings should, of course, be such as would not be affected by the acid or heat.

2. In manufacturing alum according to Mr. Spence's process, patented 1845, it has been customary to heat the liquors employed to digest the shale by passing steam through them when all placed in the same vessel, but this mode was attended with this inconvenience, that the liquor could never be raised to a temperature sufficiently high to dissolve all the shale. Now the improvements under this head consist in heating the liquors, in a separate vessel, to 150° or 200° Fah., and then running it in upon the shale.

3. It has been usual to dilute the sulphuric acid with the mother liquors repeatedly, whereby a considerable portion of the acid is thrown out and lost, in consequence of its combination with alumina and iron. The patentee, therefore, proposes to mix them with the ammoniacal liquors of gas-works, to form sulphate of ammonia, which is afterwards mixed with the sulphate of alumina, whereby the fresh and previously-formed alum is deposited.

Claims.—1. The use of glass in pieces, frames, or sheets, to construct the chambers used by sulphuric acid makers (or other vessel for the same purpose), of whatever form or size, so as to present to the interior a glass surface.

2. Heating the liquors employed in digesting shale in a separate vessel.

3. Mixing the mother liquors with ammoniacal liquors, to form sulphate of ammonia.

HENRY DUNNINGTON, Nottingham, manufacturer. *For improvements in the manufacture of looped fabrics, and in making gloves and hat-bands.* Patent dated April 3, 1849.

The patentee, who has disclaimed the three last words of the title, "and hat-bands," states that his improvements consist :—

1. In introducing additional warp of wool, or other suitable material, into warp looped fabrics, for the purpose of producing a raised surface, which is afterwards to be teased or carded in order to obtain a warm interior surface for shirts, drawers, gloves, &c., by means of three wheels, the top and bottom ones of which work the bars of the silk or body warp while the middle one works the worsted or additional warp.

2. In a peculiar mode of cutting the material, employed to manufacture gloves, into four pieces.

Claims.—1. The mode of manufacturing looped fabrics.

2. The mode of manufacturing gloves.

WILLIAM PARRY, of Plymouth, esquire. *For certain improvements in shoeing horses, and in horse-shoes.* Patent dated April 3, 1849.

The object of the present invention is to obviate the employment of nails in shoeing horses, and prevent their being lamed by the

nails being driven awry, which often occurs even with the most skilful workman. The patentee effects this by drilling holes in the hoof to correspond with those in the shoe, and attaching the one to the other by stout wire, the ends of which are twisted and imbedded in the fullering groove or in recesses, in the bottom of the shoe. The holes in the shoe are made round, and when recesses are employed, they are filled up with iron cement. The wire should be of a diameter proportionate to the weight of the shoe, and well annealed. When the holes have been drilled, the shoes may be affixed by any unskilled person without fear of injury to the horse.

Claim.—The means described of applying and affixing horse-shoes, and of manufacturing shoes to be so applied and affixed.

Samuel Alfred Carpenter, Birmingham, Warwick, manufacturer. *For a certain improvement in or substitute for buckles.* Patent dated April 3, 1849.

Mr. Carpenter's substitute for the ordinary buckle, consists in placing two links upon the strap of a brace, the top of which is fixed thereto, and the other left loose, but attached to the support of the tabs. A strap of leather, or other suitable material, is looped through the two links, and wedge pieces attached to the two ends. One of the wedges is employed to jamb the strap in the lower link, and thereby hold it fast. When it is removed, the links may be moved to or from each other, and the length of the brace be regulated accordingly.

Claim.—The substitution for a buckle of a fastening, in which the strap is held by a wedged action.

Alfred Wollett, of Liverpool, artist. *For improvements in gun-carriages.* Patent dated April 3, 1849.

Mr. Wollett's invention relates to the construction of the carriages for ship and fort guns, and consists in making them in two parts, in order that the top cheek, carrying the gun, may move laterally upon the lower one, so that the breech and muzzle may describe portions of a circle, in reverse directions, upon a central pivot, which is, in fact, the bolt that connects the two cheeks together. This movement is effected by means of a regulating screw and of a graduated arc (of 40° on each side of the central line), over which the breech of the gun travels, whereby it may be trained fore and aft at almost any required inclination. A horizontal wrought iron shaft, which is attached to a bolt beneath the centre of the port, and to another one let into the deck, passes between two sheaves fixed in the fore axle of the carriage, and serves to retain it in position, with the assistance of the ordinary breeching tackle, and to check the recoil by a compressor. In the case of a bow, stern, or midship gun, the shaft is made to take off the bulwark-bolt, in order that it may be attached to any one of a circle of bolts, and admit of the gun being brought to bear on whatever part of the compass may be desired.

Claim.—The improvement in gun-carriages as described.

James Godfrey Wilson, engineer, Chelsea, and William Pidding, Elizabeth-street, Pimlico. *For improvements in obtaining perfect combustion, and in apparatus relating thereto, the same being applicable to every description of furnace and fire-place, as also to other purposes where inflammable matter or material is made use of.* Patent dated April 3, 1849.

These improvements consist in introducing and distributing jets or streams of atmospheric air among the burning fuel of a furnace or stove, and in mixing them with the flame of a gas-burner, or spirit or oil lamp; also in constructing air passages in the wicks of mould candles.

Claims.—1. The mode or modes of constructing and arranging apparatus applicable to steam boiler and other furnaces, whereby the combustion is assisted and more perfectly obtained by the admission and distribution of jets or streams of atmospheric air into and amongst the fuel under combustion.

2. Constructing and arranging apparatus applicable to stoves and domestic grates, whereby the combustion is assisted, and more perfectly obtained by the admission and distribution of atmospheric air in and amongst the fuel under combustion.

3. The adaptation of hollow air passages to gas-burners, or oil or spirit lamps, whereby the combustion is assisted and more perfectly obtained by the introduction and mixing jets or streams of atmospheric air with the flame of the gas or liquid.

4. Constructing hollow air passages in the wicks of mould candles.

Robert Gordon, Heaton Norris, Lancaster, engineer. *For certain improvements in the ventilation of mines.* Patent dated April 4, 1849.

Mr. Gordon remarks, that the present system of furnace ventilation in coal mines is uncertain and dangerous, in consequence of the liability of the attendant to be rendered heavy and sleepy by the inhalation of noxious fumes, so as to neglect his duty, and of the temperature of the current of air to become lowered by the water which oozes through the strata, whereby, if the barometer suddenly falls, or an eddy forms in the up-cast shaft, the ventilation will be stopped; and,

lastly, of the fire being put out by choke-damp. Now, this invention has for its object to prevent accidents to the miners from the occurrence of any one of these circumstances, by closing the mouth of the up-cast shaft, and leading the air from it to the ash-pit of the steam boiler furnace, the door of which is closed, in order that the air necessary for combustion may all be drawn from the mine. Communication is also opened between the mouth of the up-cast shaft and the chimney direct, for the purpose of enabling the attendant, who will be under the observation of the bank inspector, to prevent such quantity of gas as would put out the fire from passing to it, and causing it to flow into the chimney, up which it will be drawn by the draught from the fire, the furnace door being opened for that purpose. The patentee also proposes to close the shafts when the miners are absent, and to exhaust as much of the contents as possible, so that the deleterious gases which lurk in the crevices of the mine may be drawn out and adulterated by allowing a current of air to rush in suddenly and mix with them.

Claim.—The construction and arrangement of a chimney with furnace or furnaces in connection with the up-cast shaft of a mine, to obtain more perfect ventilation than at present, including the closing of the down-cast shaft, as occasion may require.

Specification Due, but not Enrolled.

Richard Satchell, of Rockingham, Northampton. *For improvements in machinery for depositing seeds, and hoeing and working land.* Patent dated March 28, 1849.

WEEKLY LIST OF NEW ENGLISH PATENTS.

James Higgins, of Salford, Lancaster, machine maker, and Thomas Schofield Whitworth, of Salford aforesaid, mechanic, for certain improvements in machinery for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials. Septemb3r 24; six months.

The above patent being opposed by caveat at the Great Seal, was not sealed till 2nd October, but bears date the 24th September, the day it would have been sealed had no opposition been entered.

William Jamieson, of Ashton-under-Lyne, Lancaster, machine maker, for certain improvements in looms for weaving. October 4; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Oct. 1	2041	John Gray	Edinburgh	Gravy dish.
,,	2042	William Frederick Padwick	Southampton	Garden drill.
,,	2043	Gray and Keen	Liverpool	Aural log timer.
,,	2044	John Benjamin Winder	Birmingham	Envelope.
3	2045	Josiah Human, C.E.	March, Cambridgeshire	Water elevator.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1366.] SATURDAY, OCTOBER 13, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

PLUMMER'S PATENT IMPROVEMENTS IN FLAX MACHINERY.

Fig. 1e.

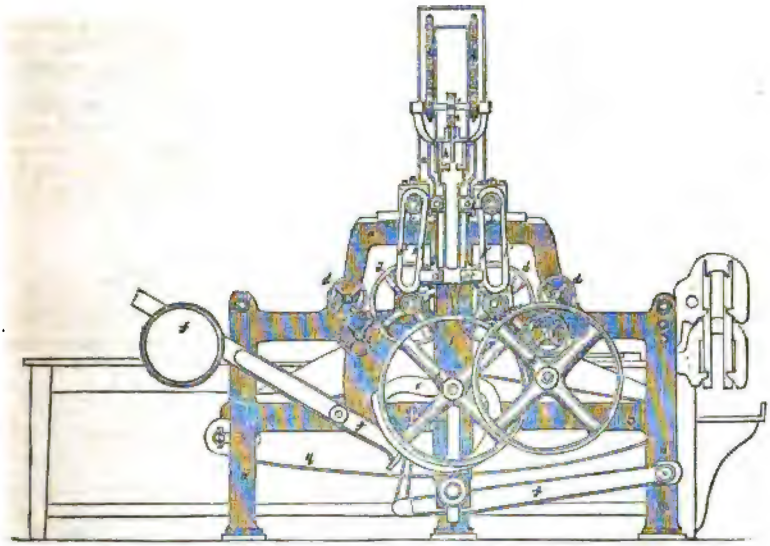
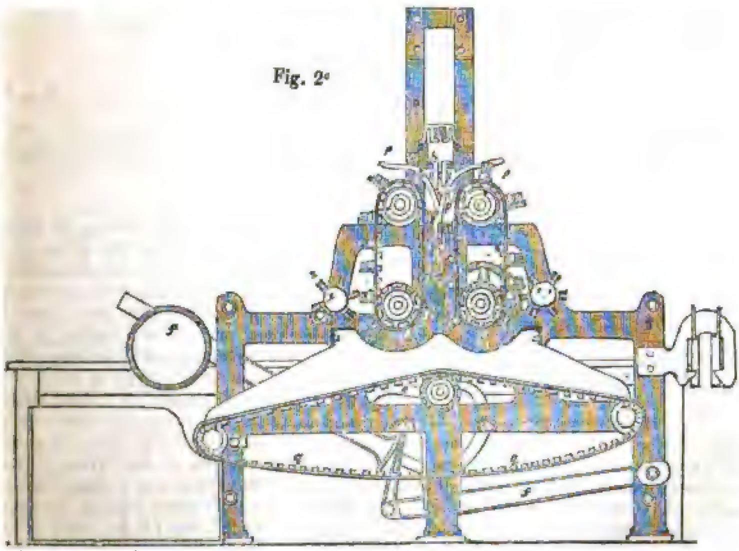


Fig. 2e



PLUMMER'S PATENT IMPROVEMENTS IN FLAX MACHINERY.

(Continued from page 317.)

Fig. 3c.

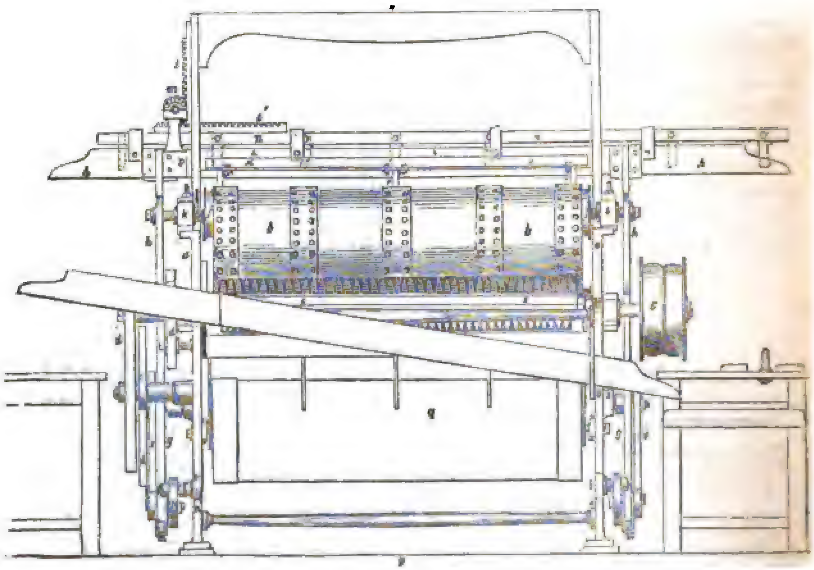


Fig. 4c.

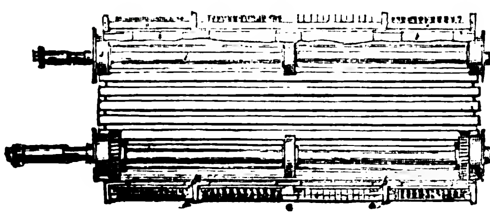


Fig. 6c.

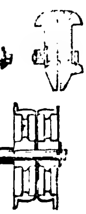


Fig. 5c.

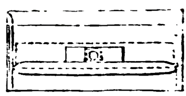
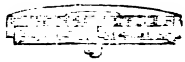
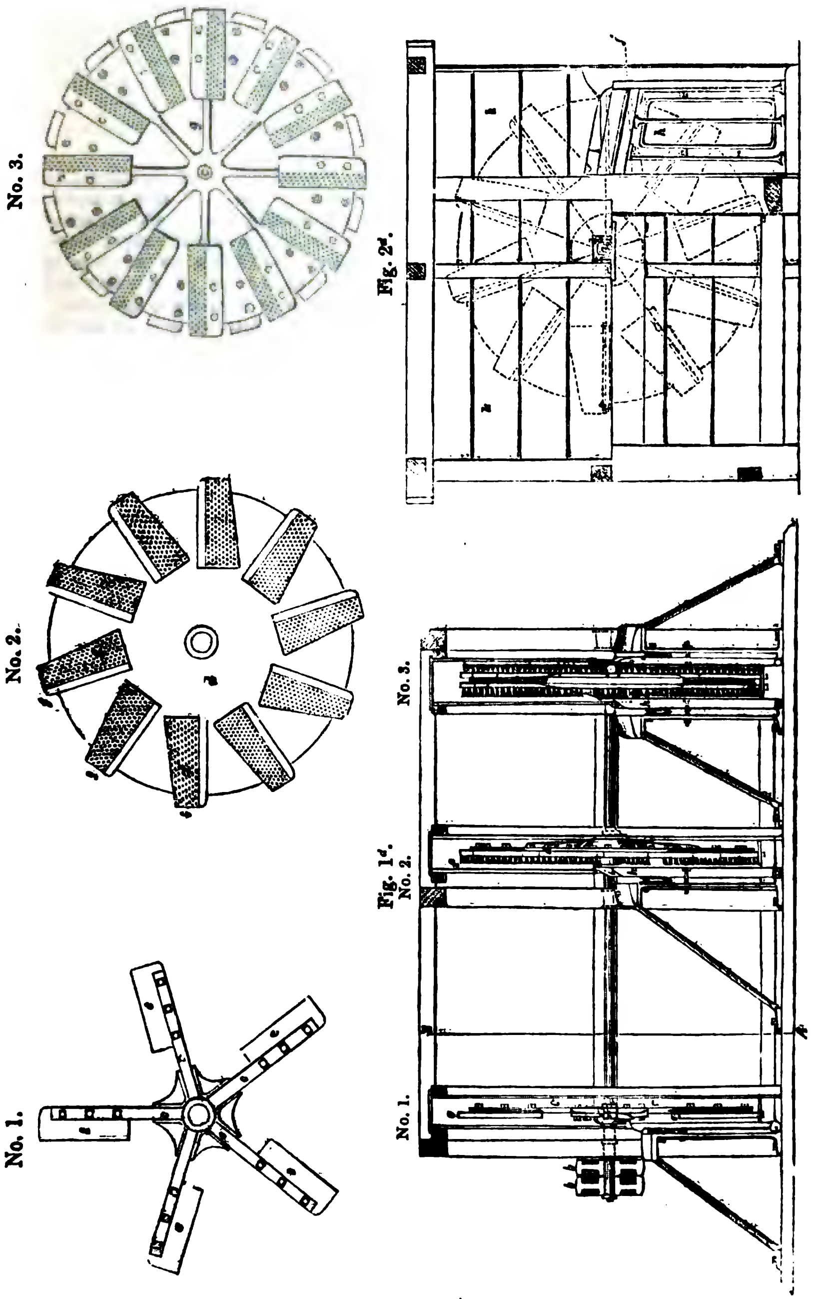


Fig. 7c.



III.—Mr. Plummer's "improved heckling machine" for long flax is designated by him from its peculiar mode of action, "The Oscillatory Double Cylinder Upright Heckling Machine." Although peculiarly adapted to long flax, it is stated to be also applicable to the dressing or improving of materials of various lengths.

Fig. 1c is an end view of this machine; fig. 2c, a cross section on the line $x\,y$; fig. 3c, a side elevation; and fig. 4c, a longitudinal section. In this machine, as in both of those before described, the streak of flax or other material is acted upon by two sets of heckles, or brushes, rotating in opposite directions, and on opposite sides of the streak, and intersecting one another, whereby the streak receives both a front and back stroke at one and the same time; but here the heckles, or brushes, instead of being attached to cylinders are attached to endless bands, each of which revolves round a pair of sheaves, *j j*, placed at a little distance, one above the other, so as to cause the band to travel in one oblong path. A peculiar oscillatory motion is also given to these bands to and from one another, whereby, on the descent of the trough, *h*, which contains the holder, the bands, which are then open at top, begin to close gradually upon the

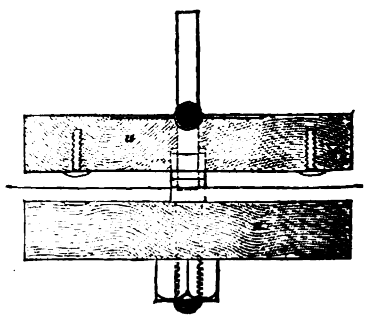

No. 3.
No. 2.
No. 1.
Fig. 2d.
Fig. 1d.
No. 3.
No. 2.
No. 1.

streak, and when the trough rises, the bands which are then closed begin to recede gradually from it. The ends of the flax, or other material, are thus prevented from being over dressed, and the full power of the heckles, or brushes, is only applied where most wanted; namely, to the body of the streak. The oscillatory motion just referred to is obtained by placing the axis, *i i*, of the top sheaves, *j j*, in shifting or sliding bearings, *k k*, and inserting the ends of these axes in slots or links, *h' h'*, formed in wings or flanges to the trough lifting frame, *g*, which slots or links are inclined towards each other at top, and from each other at the bottom (see fig. 1c), so that when the trough containing the holders is lowered, the distance between the axes of the top sheaves is lessened (through the action of the slots or links on the ends of these axes), and when the trough is raised a reverse effect is produced. The endless bands of heckles, or brushes, have moveable stripping bars, *o o*, and guards, *p p p*, attached to them, of the same description as those employed in the other machines before described; but in this case the guards are carried down between the bands to a little way below the centres of the lower sheaves, *j j*. The holder is of the same improved construction as that described under the second head of this specification (see the separate representations of it given in figs. 5c, 6c, and 7c); but in this case the traversing of the holder in the trough is effected by means of racks and pinions, as shown in figs. 3c and 1c. Two racks, *l l*, placed parallel to one another, are affixed to the framework, *a*, of the machine, and two pinions, *m m*, work into these racks, which pinions are carried by a cross axle, supported by bearings attached to the trough, *h*. On the centre of this cross axle there is a third pinion, *m'*, which gears into a third rack, *l'*, on the top of the finger-bar, *n*; so that when the trough, *h*, is raised, the pinions, *m m*, are also raised, and the third pinion, *m'*, taking into the rack on the top of the finger bar (which is provided with fingers, or catches, as usual), causes the holders to move along the trough. The tow and shive doffed from the heckles and brushes, are received on a revolving endless chain of bars, *q*, precisely similar to that employed in the double cylinder heckling machine before described. And there are also brushing cylinders, *s s*, to clean the working heckles or brushes, of the same description as those made use of, in both the preceding machines. Motion is given to the various parts of the machine (those excepted which belong to the peculiar oscillatory motion), by a combination of pulleys, wheels, &c., similar to that represented in the engravings of the double-cylinder heckling machine, and before described.

IV. The "Rotary Disc Scutching Mill" is intended to imitate more closely than has yet been done by machinery, the process of hand sc tching in its pliant adaptation to the materials to be scutched.

Fig. 1d is a front elevation, and fig. 2d, a section on the line, A B, of a machine, in which the present plans of scutching are contrasted side by side with my improvements. A is an axis which has its bearings in a casing, *k*; and *l l*, are pulleys, by which a rotary motion is imparted to this axis from any convenient first mover. In the ordinary scutching machine this axis carries a number of radial arms, *c c*, with marked knives or blades, *e e*, attached to them, as is more clearly shown in the end view given separately in the figure marked No. 1. For these arms I substitute a disc, *d*, with sets of brushes, *f f*, (composed of materials the same as, or similar to, those used in the double brushing cylinder machine first described,) affixed to it, as also separately shown in the figure, No. 2; and such brushes I affix, either to one side or both sides of the disc, (as shown in the figures, No. 2 and 3), in which last case each disc has two berths, as it is technically termed, that is to say, both a right-hand berth and a left-hand berth. The disc may be either in one solid piece, or of several pieces, or arms, having the intermediate spaces filled in with webbing or some other suitable material (by the adoption of which last method old mills may be converted into mills of this improved form) the object in superseding the use of detached arms being to exclude those cross currents of air which are produced by the revolution of the arms of the common scutching mill, and cause the flax to rise from the scutching board, and curl round the edges of the knives or blades, to

Fig. 5d.



the great damage of the staple. The brushes may be attached to the discs at any desired angle or angles of inclination (some at one angle and some at other angles); and there may be a greater number of brushes attached to each disc than can be attached to a series of radial arms—both of which are great advantages which the disc form of construction possesses over the open radial arms. The top, *i*, of the scutching board, *h*, on which the flax, or other material to be scutched is laid, is placed a little above the centre of the axis, A, so that a straight line drawn from the centre of the axle, would intersect the middle of the top line of the scutching board, or nearly so, instead of passing below it, as would be the case were the scutching board placed as usual, and as is indicated by the dotted line, *j*. The flax or other material is held while being scutched in a holder, as in the different machines before described, in order that it may be more fully and evenly spread out, and thereby more thoroughly subjected to the action of the scutchers. A form of holder suitable for this machine is represented in figs. 3 ^{d}, 4^d and 5^d. Fig. 3^d being a plan of this holder of half the real size. Fig. 4^d, a sectional elevation of it; and fig. 5^d, a cross section on the line C D. *a a'* are the top and bottom pieces which are made of wood; *b* is a hinge, on which the two pieces turn; *c* is a single handle attached to the hinge *d* of the holder, and *d d*, a pair of handles attached to the opposite end, one to the top piece and the other to the bottom piece; *e* is a catch, affixed to the bottom piece, the upper half of which turns backwards and forwards on a pin at *e'*; *f* is a hole in the top piece, through which the catch *e* passes when the top piece is down: *g* is a barrel spring which presses against the catch *e* after it has passed through the hole *f*, and fastens the top piece down upon the streak within the holder.

Fig. 3^d.

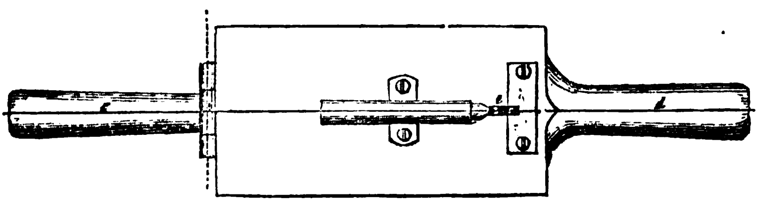
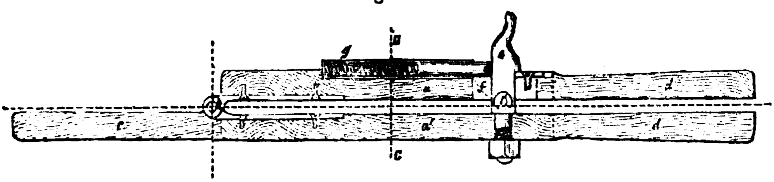


Fig. 4^d.



By this means improved scutching machine, and the use in connection therewith of a holder such as before described, a much greater yield of fibre is obtained from the straw, and the quality of the fibre is also greatly improved, so much so as in some cases considerably to diminish the quantity of heckling subsequently required.

Discs may be also employed with knives or blades, or other rigid scutchers attached to them, or with rigid scutchers in combination with brushes.

(To be concluded in our next.)

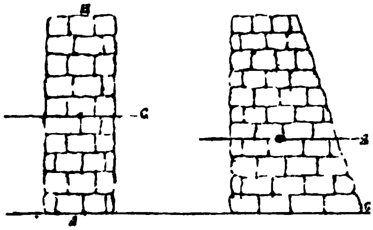
ON THE APPORTIONMENT OF THE COST OF EARTH-WORK IN FORMING EXCAVATIONS, EMBANKMENTS, ETC. BY T. SMITH, ESQ., C. E.—(CONCLUDED FROM P. 121.)

If the formulæ I have given in the previous part of this paper contain any value whatever, it must be sought for alone in their practical application to the physical operations, in which men find themselves every day more or less engaged. To illustrate such application, I shall therefore take a few obvious examples, and proceed to show as briefly as I can, the arithmetical process to be pursued.

If AB (fig. 4) be the section of a rectangular wall, 10 feet high, 1 foot in length, and 2½ feet thick, the material of which is to be raised from the plane AC at the *average* cost of twelve

pence per cubic foot; the correct price, per unit, in any layer of this section is required?

Fig. 4.



In this case the figure of the section being a rectangle, equation (2) will give $\delta = \frac{h}{2} = 5$ feet; and from equation (5) we find

$$P_{\text{II}} = \frac{P_1}{\delta} = \frac{12}{5} = 2{\cdot}4 \text{ pence.}$$

Also, the number of layers is 10, and the distance over which each layer has to be removed is (equation 6) represented respectively by the terms

$\frac{1}{2}+\frac{3}{2}+\frac{5}{2}+$ &c., continued for 10 terms.

Therefore the correct price per cubic foot for each layer is

1st.	layer	=	1·2	pence.
2.	,,	=	3·6	,,
3.	,,	=	6·0	,,
4.	,,	=	8·4	,,
5.	,,	=	10·8	,,
6.	,,	=	13·2	,,
7.	,,	=	15·6	,,
8.	,,	=	18·0	,,
9.	,,	=	20·4	,,
10.	,,	=	22·8	,,

Now the whole mass contains 20 cubic units, which, taken at 12 *d* = 240 pence; and if the cost of each layer be calculated at the prices above assigned, it will be found that the *total* expense by partial removals will equal 240 pence as required.

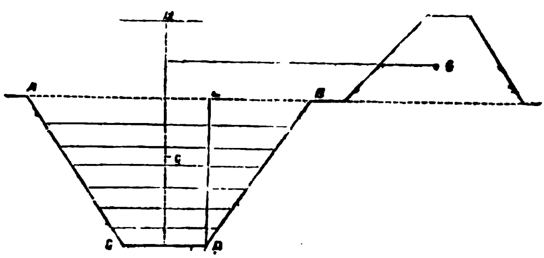
I shall now suppose the wall to batter upon the face, say 2 inches to a foot (as shown in fig. 4.), the height and length being the same as in the last case. The thickness at top being 2 feet, and height 10 ft., the base will be 3 ft. 8 inches. In this case, by a slight modification of equation (1), we shall find $\delta = 4{\cdot}5$ feet, and, therefore, $P_2 = \frac{12}{4{\cdot}5} = 2{\cdot}666$ pence. The number of layers being 10, and the distance over which each layer has to be removed being represented by the terms $\frac{1}{2}+\frac{3}{2}+\frac{5}{2}+$ &c., continued for 10 terms, the correct price per cubic foot for each layer is therefore (equation 6).

1st.	layer	=	1·333	pence.
2.	,,	=	3·999	,,
2.	,,	=	6·666	,,
4.	,,	=	9·333	,,
5.	,,	=	11·999	,,
6.	,,	=	14·666	,,
7.	,,	=	17·333	,,
8.	,,	=	19·999	,,
9.	,,	=	22·666	,,
10.	,,	=	25·333	,,

Now, the solid contains 28·33 cubic feet, which at 12 pence per foot = 340 pence; and if the cost of each of the 10 layers into which the section is divided, be calculated at the above prices, the sum of the items thus found will equal 340 pence very nearly.

In the foregoing cases the unit of measure has been taken at 1 foot; in the following example, however, the yard shall be adopted as being more analogous to the species of work contemplated.

Fig. 5.



Let ABCD (fig. 5) be the section of an excavation, the depth LD = 7 yards, side slopes $1\frac{1}{2}$ to 1, and bottom breadth CD = 5 yards. The *average* price in this case is *six pence* per cubic yard, and it is necessary to pay for the work at short periods, as the excavation proceeds: What is the value of a cubic unit in any layer of the section?

From equation (3) we have for the distance of the centre of gravity of the cutting, below the plane AB,

$$\delta = \frac{7}{3} \cdot \frac{10+26}{5+26} = 2{\cdot}71 \text{ yards.}$$

Therefore, equation (5)

$$P_2 = \frac{P_1}{\delta} = \frac{6 \text{ pence}}{2{\cdot}71} = 2{\cdot}214 \text{ pence.}$$

Now, the number of layers in this case being 7, the approximate price for each layer is represented by the terms

$$\frac{2{\cdot}214}{2} \cdot \left\{1 \cdot 3 \cdot 5 \cdot 7 \cdot 9 \cdot 11 \cdot 13\right\} .$$

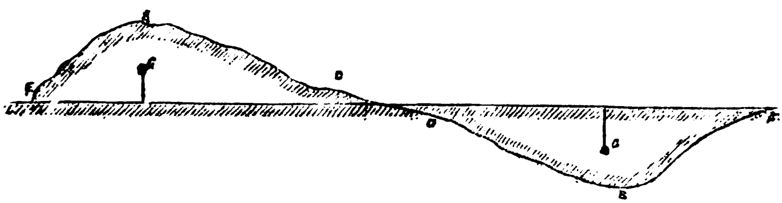
Whence the price per cubic yard for the

1st layer	=	1·107	pence.
2. ,,	=	3·321	,,
3. ,,	=	5·531	,,
4. ,,	=	7·749	,,
5. ,,	=	9·963	,,
6. ,,	=	12·177	,,
7. ,,	=	14·391	,,

And if the cost of the removal of each layer, 1 yard in depth, be calculated at the above prices, the sum of the items thus found, will approach so near to the amount resulting from the whole mass taken at the *average* price, that the difference may be safely neglected in any practical computation.

When the material is to be deposited on one or both sides of the excavation in regularly formed embankments, or in any form which may be considered most convenient for the spoil, in such case, as in the others, it is necessary in the first instance to determine the distance δ of the common centre of gravity of the embankments, above the centre of gravity of the cutting, which distance (equation 5) is requisite in finding P_2. This latter element however, being found, the first member of the expression (7) determines the prices for the cutting, and the second member those for the embankment.

Fig. 6.



Hitherto the removals have been supposed to take place only in a vertical direction; but it is very obvious that the general principle which I have endeavoured to apply to these particular cases will be found equally applicable to any horizontal or inclined plane. If it were required to cut away the mass A (fig. 6), and deposit it so as to fill up the hollow B, at an *average* price P, per cubic yard; it is plain that the value of a yard taken from C, and placed at D, is very different as compared with that of a yard taken from E and placed at F. The correct apportionment of the value of a cubic unit removed from any part of A to any part of B, with reference to the *average* price P, may however be readily indicated by the application of the preceding formulæ.

Permit me in conclusion to observe, that having myself experienced the practical value of the rules investigated in these papers, and having had occasion frequently to apply them under various modifications in the execution of deep cuttings and embankments with much advantage; I have only to hope, should they not prove equally useful to other parties engaged in such works, they may,

at least, serve to draw the attention of competent individuals to this interesting subject, the complete development of which, could not fail to furnish many important desiderata to the practical engineer. In carrying on large projects under the very efficient system of "*piece work*," it is necessary to make frequent periodical payments to the sub-contractors or workmen, as the case may be; and it appears to me utterly impossible that the fair value of the *work done* at the end of any particular period can be arrived at upon any guiding principles, other than those so very imperfectly discussed in these communications. I need hardly observe that the formulæ assume that the labor of getting and filling a cubic unit is the same for each stratum of the cutting; nor do they contemplate the occurrence of the usual contingencies as to unwatering the work where necessary. These fluctuating matters, however, can only be dealt with as they occur, being subjects for the distinct and separate exercise of the judgment in each particular case, and far removed beyond the powers of previous calculation.

J. SMITH.

Bridgetown, Wexford, Sept. 28, 1849.

ON THE CONSTRUCTION AND VENTILATION OF COVERED DOCKS, WITH SELECTIONS ON THE SUBJECT FROM THE MSS. OF THE LATE BRIG.-GEN. SIR SAMUEL BENTHAM.

Messrs. Chambers, in their *Edinburgh Journal* of the 1st Sept., in giving an account of the Thames Bank Building Works, say that the proprietor, Mr. Thomas Cubitt, employs from above 1,500 to 2,400 men, whose "comfort and safety are presided over with a care almost parental. A comfortable temperature is maintained by an ordinary heating apparatus, and is regulated by thermometers;—the ventilation is complete." And so also, many other manufacturers have enclosed, warmed, and ventilated the places where work is carried on; but in our extensive manufactories for the building of ships, such improvements are still a desiderata.

Sir Samuel Bentham, in his letter to the Navy Board of 9th March, 1812, said that, "An investigation of the circumstances which have contributed to the prosperity of the best regulated manufactories, would show that a constant attention to the heating and ventilating them, has had no inconsiderable influence in their success; and that, over and above the satisfaction experienced from considerations arising from motives of humanity and benevolence, the most intelligent manufacturers have been convinced, that work done by a given number of people in a given time, under such *favourable* circumstances, is so much *better* in *quality*, as well as *greater in quantity*, as to render a disregard of such particulars improvident on the score of interest." He therefore proposed, as subservient to the building of ships, the erection of structures which should be as well lighted, as well warmed, and as well ventilated, as the best private workshop or manufactory.

The structure he proposed was a covered dock.

He brought to notice, that the covering of ships and docks was no new invention, but that the best of those that had been constructed, namely, the covered docks at Carlscrona, did, it is true, protect the ships building under them from rain; but as those structures had large openings at the head and at the sides, and as they were quite open at the stern, the currents of wind that passed through them were "found to be so injurious, as well as uncomfortable, to the workmen, and so detrimental to the materials, by causing them to *rend*, that the disadvantages attending them were found to overbalance their advantages." Since 1812, many docks and ships in the Royal Dock-yards have been covered, and by degrees they have been less and less imperfectly inclosed, but still not any one of them can be considered as a well-constructed workshop.

Sir Samuel objected to slips for shipbuilding on account of the "inconveniences arising from the means necessary to set the ship afloat when built. The operation of launching a large ship, besides being a considerable source of expense, never fails to strain more or less the connexion of her parts. Every large ship is known to *break* in launching to a degree easily perceived by measurement. In one case that has lately occurred, the breakage was shown, as I understand, to have amounted to between six and seven inches; that is, her form was so much altered as to have occasioned the parts that ranged in a straight line *before*

launching, to have become six or seven inches out of a straight line *afterwards*."* Therefore, with a view to prevent breakage, he proposed that shallow docks should be provided, instead of slips.

The covered docks which he devised was for first-rate vessels of war. A similar arrangement, on a smaller scale, would be equally appropriate for the construction or repair of merchantmen; and, therefore, the publication of his description of the design may, sooner or later, lead to its adoption—varying some lesser details, perhaps, to suit local circumstances or the particular views of private ship-builders.

"In contriving the covered building dock," he said, "of which I now present the design, I have not confined myself merely to obviate the above-mentioned several inconveniences;† but I have also provided several lesser accommodations, with a view to facilitating the several operations necessary to the construction of a ship." The description is continued in the following terms:—

The dock itself, that is, the part of the structure which is below the level of the ground, is made of a depth rather more than sufficient to receive a ship of the largest size in her light state, such as that in which she is intended to be when newly built, or when cleared to be taken into dock for a thorough repair, and this with her keel but just clear of the bottom of the dock at the time of high water. The form of the dock is such as to afford space sufficient for carrying on all the operations necessary for the construction or repair of a ship. Over the dock rises a superstructure of a quadrangular form, on the plan, just large enough to include the dock within it. The sides of this superstructure are of brick or stone, rather built up as piers than as a solid wall, so that the sides and head of this structure consist of windows, which are glazed, and extend from a little above the level of the yard to very nearly the top of the building; and several of these windows are made to open, some only for the admission of air when requisite, others for the convenience of taking in materials. The support of the roof is of cast iron, and the covering of a composition proper for keeping out water, and easily repaired. Along the middle of the roof runs a long range of lantern windows; and several of the windows, as well as doors at the sides are made to open when requisite, and particularly at the head, for driving more conveniently the very long bolts used for fastening the hull of the head. The stern is contrived with large wooden doors, of the height and breadth requisite for the exit or entrance of a ship of the largest size. These doors, instead of opening on hinges, as usual, are to slide up and down, supported by counterpoises like the sashes to windows; and so that when both are let down, they shall be readily connected to, and consequently taken away with, the floating dam while the ship is passing in or out; and when the dam is replaced, and the counterpoises again hooked to these sliding doors, they may be closed again at pleasure.

As to the interior of this building, it is contrived with a view to the performing within it all the smaller works which require to be measured, fitted, formed, and suited to each particular ship while building, as well as for carrying on the larger operations which have always been done on a building slip.

In a space under ground, by the side of the dock, fire-places with flues are so contrived as to give heat to the interior of the building when artificial heat may be required, and so that at other times, although these fires be used for other purposes, their heat may be prevented from being communicated to the dock by closing the apertures to the building, and by opening a more direct passage for the fire and smoke to the chimney. Two of these fires are to serve for heating two kilns, serving at pleasure either for steaming or boiling planks, and placed one on each side of the building; a third fire for working a small steam engine; a fourth for a smith's forge.

The steam-engine, it is designed, should give motion to various small articles of machinery, as grindstones, whet-stones, and laps for grinding and setting tools; circular saws for joiners' use, borers and drills of different kinds, coaking tools, &c., as also occasionally for assisting in the hoisting and moving various of the heavy materials within the building. The small smiths' shop is for cutting off and pointing bolts, preparing or finishing various articles of iron work that require, after their previous manufacture, to be bent, shaped, or otherwise altered so as

* Since the year 1812, many of the improvements Sir Samuel had introduced in his experimental vessels, 1795, have been very generally adopted, such as diagonal braces and fixed bulk-heads, both of which contribute so materially to the strength of a ship; and that which he so strongly advocated—the application of mechanical principles to naval architecture—has of late been more or less attended to, so that it does not seem now probable, that any such great amount of breakage occurs in ships of the present day; but still they are usually found to break more or less on launching.

† He had enumerated a great variety of inconveniences attendant on the then existing mode of building ships.

to suit exactly the parts of the ship in which they are to be placed.

Along the sides of the dock are erected standards of iron, in the same places and for the same uses as those usually made of timber, but serving at the same time for the collateral purposes of support to the roof of the building, as well as to tiers of rafters running along the sides and head at different heights, as also at one height across the stern.

The rafters above mentioned are for the support of stages in the form of galleries; but the greater part of the flooring of these galleries it seems desirable should be formed by planks of wood moveable at pleasure, so that, according to the different parts of the ship that might be in hand, this temporary flooring should be laid only where particularly wanted, so that the light should not be interrupted more than necessary. These galleries, as well as the spaces left at the head and round the side of the dock, are designed as working places for artificers;—the larger spaces on the ground level for trimming timbers and other cumbersome and heavy work;—the gallery floors for edging plank, for house carpenters' and joiners' work.

The interior of the roof is constructed so that along the whole length of the dock, *hanging* railroads (as they might be called) may be formed in different places, along which railroad carriages would traverse from end to end, whereby the frames of the ship, the beams, the plank, and other articles which it may not be necessary to carry by hand, might be raised and conveyed to the different parts of the ship without interfering with the work places.

In regard to lighting the interior of this covered dock at night, it seems most desirable to introduce *gas* lights for the general lighting, although some portable lamps may likewise be requisite.

Such being the kind of covered docks which I would propose should be used for the building of ships, instead of building them on slips, as at present, the advantages and new effects to be expected from this change are principally as follows:—

The materials if taken into such a covered dock, already in the dry and seasoned state to which they would be brought in seasoning houses such as formerly proposed by me of the 6th inst.,* would at least be kept in that state; or even if not already perfectly dry and seasoned, means are afforded in this dock of completing this operation—so essential to the durability of the ship—with more or less rapidity at pleasure, while the work of the ship is going on.

The scarphs of the timber, the treenail holes, the seams of the planks, the junctures of every kind, would be *put together in a dry state*, and might therefore be expected to become afterwards closer together, instead of more open; so that not only the mischief likely to arise from penning up water in these junctures, and thereby giving rise to the dry rot, as well as to the common rot, would be altogether avoided in the first construction of the ship, but the junctures being more perfectly closed, the entrance of water after the ship was afloat would likewise be less probable. Besides which, the wood being in this state of dryness, any intermediate substance or pigment, such as tar and hair, white lead, &c., which has or may be found useful for the better keeping out the water from the junctures, may be applied with the best effect. So in regard to the paying the outside with pitch or tar, the caulking, and the sheathing, these operations would all be performed while the whole should be in the driest possible state, of the materials themselves as well as the ship.

As to the advantages arising from a sufficiency of light, it is evident that beginning at the bottom of the ship, and *completing* the work as it advances upwards, so that the whole of the work under each deck should be finished before the deck itself should be laid, the artificers would have the advantage of light in the performance of all their work; and the whole, from first to last, would be open constantly to the inspection of all the officers.

In regard to the minor arrangements and contrivances, the hanging railway, with its cranes, counterpoises, and other apparatus, would afford the means of removing from place to place, of raising and suspending the heavy parts of the ship with a facility hitherto unattainable; the artificers would be relieved from that part of the labour from which they are known to receive their most frequent hurts, and the most permanent injuries, by occasionally overstraining themselves. Besides which, the heavy parts of a ship might be put together with more accuracy when united with ease, and in a great degree counterpoised during the time of adjusting them in their places. By placing the kilns for steaming or boiling the planks *within* the covered dock, the plank might be applied to its situation, and bent in its hottest state.

The workshops, or galleries, afforded within the structure would be productive of a very considerable saving of that time which is now unavoidably spent in taking orders, measures of work, and in carrying the work itself backwards and forwards between the slips and the several workshops spread about the yard; besides which the

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* Mech. Mag., No. 1282.

particular officer superintending the construction of each ship, would have the whole of the work requisite for it under his immediate inspection.

The ship being completed in every respect, and the bottom coppered without the need of being taken into another dock for this purpose after being launched, she may be floated out of the dock in which she was built as well as out of any other one—excepting that on the supposition of its being made for the sake of economy, only deep enough for the keel of the ship to pass over the side of the dock, and that the keel for convenience in building, has been placed four or five feet above that level, it will then be necessary to pump water into the dock sufficient to float the ship in its elevated position, so that while in that state the blocks may be drawn from under the keel; or that the ship itself may be removed on one side clear of them, when by lowering the water in the dock to the level of that outside of it, she may be taken out as usual; thus the operation of launching, with its attendant evils, would be altogether done away.

To the advantages above enumerated, is still to be added that of the most immediate importance, namely, *expedition*.

In a covered dock, the timber having previously been duly seasoned, a first-rate ship might from its first commencement be completed even in a less time than six months, the artificers working only the hours of an ordinary day's work; but the means afforded for lighting artificially and perfectly these docks would enable a ship to be completed from the first, in the short space of *three* months, employing for the purpose a *double* set of artificers. On this occasion of first mentioning this mode of working, it seems incumbent on me to state that experience has shown that this mode of working may be carried on, not only without injury to the health of the workmen, but very much to their satisfaction.*

Sir Samuel then entered into several details of calculation, exhibiting the direct savings that would be made by building a ship in such a covered dock as he had proposed; those calculated savings being, however, only on one item of expenditure, *rent*. Supposing a ship of the line to be built in the usual way, on a slip, the shortest time of its occupation would be two years, and the rent of it during that time, including the use of sheds, &c., would amount to 3000*l*. In such a covered dock as he proposed, taking six months as the *longest* time that need be required for building a first-rate, the rent would amount to 2100*l*., leaving a saving of rent alone on each ship of 900*l*.; but supposing the ship to be built by a double set of hands in half the above-mentioned time, and allowing 2*l*. per night for lighting the building, the rent would amount to no more than 1230*l*., making a saving of rent alone of 1770*l*. on each ship built in a covered dock instead of on a slip.

At this time the cost of a covered dock would be much less than that he had estimated—consequently, the rent of it proportionably less. The diminution of cost would arise from the present low price of iron compared with what it was in 1812, but principally from the great fall in the price of glass, which constituted so costly an item of his estimate. The iron roofs of the present day seem to be built on a more expensive plan than those of his invention, since in the Navy Estimate for this current year, 1849-50, the roofs now constructing over two slips at Pembroke Dockyard are estimated at 30,00[illegible], with the addition of 2040*l*. for berthing [illegible] them; whereas the estimate of Sir Samuel's covered dock "for the covering, including glazing, interior standards and galleries, was 14,000*l*.;" so that the cost of the roofs at Pembroke exceeds in each of them by 2010*l*., the price at which they might have been constructed according to his plan, and that though both the iron and glass were estimated by him at sums so much higher than their present value. His estimate for the smith's shop, the engine-house, together with the kilns and flues amounted to about 3000*l*.

It is not to be supposed that in the Royal Dockyards new docks should now be constructed merely for the sake of exhibiting perfection in them, but the existing covered docks and slips might, consistently with good economy, be altered conformably to the above indications, and thus become really good workshops, thereby producing a considerable diminution in the cost of building ships; and what is of still greater importance, they would be better built and more durable.

It may be imagined that the present covering of docks and slips answers the purpose of keeping the materials of the ships within them dry, but that is not the case in such a climate as ours. The

* *Mech. Mag.*, No. 1344.

moisture of our atmosphere for many months of the year is abundantly sufficient to penetrate even dry wood, causing it to swell, and thus preventing the close juncture of different parts of a ship, on which its durability so much depends; but in Sir Samuel's covered docks the provisions made for warming and drying the interior atmosphere at pleasure, would afford the means of dissipating damps and fogs, however great.

Even at the present day, when the private proprietors of many manufactories, employ artificial means for seasoning timber, shipbuilders have not yet adopted this beneficial expedient. In the description of Sir Samuel's timber-seasoning houses,* he exhibited the savings that would result from the use of them. In the instance of seasoning timber for first rates, that saving would amount to no less a sum for each house than 17,478*l.* a year, whereby the capital sunk upon it would be refunded in less than the first half year. It has been supposed that by leaving ships a length of time to remain in their frames unclosed in, their timbers would thereby become well seasoned; but exclusively of the loss in rent of the slip or dock for several years, and of that of the interest on the money expended prematurely for materials and workmanship, the consequent imperfection of junctures must be again adverted to. As much as the wood shrinks in drying, so much will that imperfection necessarily amount to.

The erection of timber-seasoning houses in the Royal Dockyards would even now be a measure of economy, though the superfluity of slips, and docks, and of various other accommodations in our naval arsenals, be a great bar to the retrenchment called for. Slips and docks that have cost so much, must not be left idle; on this notion, as soon as one ship is launched another is laid down; a first-rate and three large frigates have been ordered within these few weeks. The loss on allowing a ship to lie idle would be the interest of the money sunk upon its construction; for a covered slip and its appendages the interest on some 30,000*l.* or 40,000*l.*; but might it not be more consistent with true economy to abide by the loss of even 2000*l.* a year, than to expend some 30,000*l.* or 40,000*l.* to build a frigate not wanted; or perhaps 80,000*l.* for a first-rate as little needed. For how can new ships be requisite when we have about 60 frigates unemployed in ordinary, yet at a large expense for repairs and keeping; also 54 ships of the line,* all of them over and above the many ships that are in actual service.

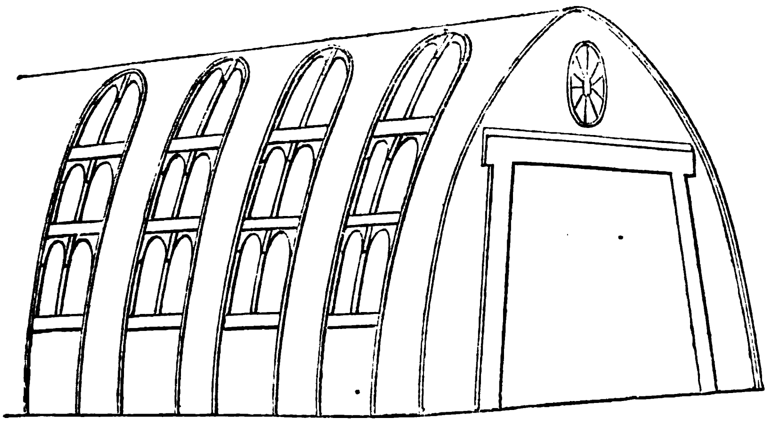
Amongst the different forms and modes of construction which Sir Samuel contrived and composed for covering a dock before he decided on that above described, there was one of which a sketch remains in the form of an arch, capable of affording great strength with a small quantity of material. This form may be considered graceful, and it afforded still more light than the nearly upright sided building, but on account of the additional quantity of glazing, it would have cost about 15,000*l.*; on this account, together with apprehensions that the novelty of form might be objected to, he was induced to present in preference the design before described. The sketch of the arched dock is here given that the idea may not be wholly lost. (See opposite page).

The hanging railroads specified in the description of the covered dock, were at the commencement of 1812 quite new, though they have since been introduced into warehouses and manufactories. This, like many other of Sir Samuel's inventions, may have occurred to other "men of ability seeking to produce a given effect;" but many of his ideas were made known by his "Naval Papers;" they were in considerable circulation from 20 to 30 years ago, though now not obtainable. Whenever he had availed himself of a useful hint, he was scrupulous in mentioning the source from which it had been derived; as an instance in point, he particularly spoke in his timber-seasoning papers of Messrs. Strutt's mode of seasoning deals at Belper. His unremitting endeavours to alleviate the ills to which working men are liable, gave rise to the invention of the hanging railroad, and to the extensive use of counterpoises—an expedient not yet sufficiently appreciated in civil engineering.

M. S. B.

* *Mech. Mag.*, No. 1282.

* See Report of the Select Committee on Navy Estimates, 1841, p. 863.



THE "ORKNEY," OR "GALLOWAY ENGINE."

Sir,—In your Magazine of the 6th Oct., I perceive there is an attempt made by Captain Fitzmaurice to claim the *first idea* of Galloway's Rotary Engine, but now styled the Orkney Rotary Engine.

Now, Sir, I think it only justice to give the merit (if any) of the invention where it is due.

Having been employed by Mr. Galloway to superintend his business, and make working and other drawings for him, I had an opportunity of knowing what his ideas were almost as soon as they were formed, which was very rapidly. On attending at the office one morning, as usual, Mr. G. showed me a sketch which he had made when the thought struck him: he asked me to make a diagram of it, and also a section of the cylinder and piston in wood, which I did; and I can *positively affirm* that Captain Fitzmaurice knew nothing of it until it was in this tangible form. I was with Mr. Galloway when he introduced the invention to the notice of Captain Fitzmaurice, who was very much struck with it; and Mr. G. then made some pecuniary arrangements about including it in a patent he was then about taking for further improvements in his locomotive engine for ascending inclines.

I am, Sir, yours, &c.,
W. Holdsworth.

Chelsea, Oct. 10, 1849.

THE ADMIRALTY CHRONOMETERS.

We collect the following particulars from a return to an Order of the House of Commons, which has just been published:

The number of chronometers allowed to be placed on trial at the Royal Observatory, Greenwich, during the last five years, has been 219.

In 1845	the first, in point of	merit was	Poole...... (1155)
— 1846	..	..	Hutton .... (138)
— 1847	..	..	Frodsham.. (2074)
— 1848	..	..	Hewitt .... (1177)
— 1849	..	..	Eiffe ...... (662)

Of the 219 placed on trial, 79 were afterwards purchased for the public use.

The highest prices given were, 68*l.* 5*s.* for Hutton (138), and the like sum for

Frodsham (2074). Twenty-one obtained only 42*l*., and a few much less. The largest number purchased from any one maker was 14, from Loseby, but owing, apparently, to other circumstances than the position which that gentleman held in the competition.

Mr. Loseby is the inventor of a chronometer compensation of great merit, and it was avowedly to reward him (in some measure) for that invention, that the Admiralty gave him such a preference in their orders. The defect in chronometers which it was the object of Mr. Loseby's invention to remove, and which it is admitted to have removed most successfully, was this—that if the compensation is perfectly adjusted for very high and very low temperatures, the chronometer *gains* at middle temperatures. The way in which Mr. Loseby rectifies this defect is, to attach to the balances of his chronometers curved tubes containing mercury. The mercury, on expanding with an increasing temperature, arrives in parts of the tubes inclined in different degrees to the radii of the balance, and therefore its successive expansions produce successive effects of different magnitude on the momentum of the inertia of the balance; and by giving different forms to the tubes containing the mercury, the law of the successive alterations of the momentum of inertia may be made to adapt itself to the law of alteration of the elasticity of the spring, whatever that law may be. The Astronomer Royal (Mr. Airy), in reporting to the Admiralty on this compensation (28th May, 1845), says, "I consider this contrivance (taking advantage very happily of the two distinguishing properties of mercury, its fluidity and its great thermal expansion), as the most ingenious I have seen, and the most perfectly adaptable to the wants of chronometers. I am not aware that it is liable to any special inconvenience." He was pleased at the same time to add, "No construction whatever for *this purpose*, however successful, can now, in my opinion, claim any pecuniary reward." And in a subsequent report (19th Feb., 1846), he gives this as his reason, "The nature of the defect, and of the modes of remedying it, were pointed out strongly and clearly by Eiffe, and contrivances for correcting it to a very considerable degree of exactness were actually adjusted by him; and after this has been once done, the merit of arranging a new apparatus for the same purpose, however ingenious (and Mr. Loseby's is really very ingenious), is very small." Mr. Airy, therefore, gave it as his opinion, that "the Admiralty should give encouragement to Loseby, not by giving him money (for a grant of which application had been made), *but by applying to him for a few additional chronometers.*" The Admiralty followed the Astronomer Royal's recommendation; and in the opinion of another important functionary (the Hydrographer), they have done all that the circumstances of the case warranted.

"The statement of the Astronomer Royal," says the Hydrographer, Admiral Beaufort, "is perfectly correct. In his Report, May, 1845, he distinctly said, that no construction for the purpose that Mr. Loseby had in view ought to be pecuniarily rewarded; but, for very obvious reasons, their Lordships did not think it prudent to establish that as an inflexible rule, and much less to publish it.

"The immediate purpose of Mr. Loseby's construction was to resist great changes of temperature, in which he had been in some measure anticipated by Mr. Eiffe; and the agent that Mr. Loseby adopted, mercury, had been already applied by M. Le Roy; yet the means by which Mr. Loseby employed that agent were new and very ingenious.

"Ultimate success, however, could not be proved by short artificial trials at home, and therefore the Admiralty, though refusing him a direct reward, have afforded him, by spreading his chronometers through all climates, the best and most satisfactory means of establishing the merits of his invention.

"In doing this, they have carried out the Astronomer Royal's principle of general encouragement, and to a great extent, as they have purchased thirteen of Mr. Loseby's chronometers, and paid him for them 630*l*."

MATHEMATICAL PERIODICALS.

(Continued from page 297.)

XVII.—*Burrow's Diary.*—(*Concluded.*)

Art. XIII. Of finding the areas of curves whose abscissas are the same as those in a circle, and their ordinates any powers of the corresponding arc, or

multiples of the sine, cosine, &c. By Mr. William Wilkins.

⁎ The following tribute to the memory of this gentleman appears in the *Diary* for 1778, and as it is perhaps the only existing record of him, we give it entire:

"The proposer (of Ques. 19) *Mr. William Wilkins*, intended to have given a solution, but untimely death prevented him; we mention with the utmost concern the loss of this very ingenious young gentleman, who, to a most engaging and amiable disposition, united those talents which bade fair to have rendered him one of the greatest mathematicians of the age. He died on January 15, 1777, in the 24th year of his age."

Art. XIV. A Specimen of a Method of Finding Rules for the Extraction of Roots. By Reuben Burrow.

⁎ This paper contains approximating rules for the *square* and *cube* roots of numbers, which are virtually the same as those to be found in most treatises on arithmetic. From Art. XX. it appears that Mr. Robertson, librarian to the Royal Society, was the first who gave the rule under the form to which Mr. Burrow's demonstration applies; but for a *general* investigation, extended to "any root whatever," reference may be made to *Dr. Hutton's Tracts*, vol. i., p. 213, or to *Davies's Hutton*, vol. i., p. 73.

Art. XV. Remarks on some Criticisms concerning the Property of the Lever. By Reuben Burrow.

⁎ The paper is intended as an answer to Dr. Hamilton's objections "against Sir Isaac Newton's proof of the Property of the Lever." The objections themselves may be seen in the first of his "*Philosophical Essays*," viz., that on "Mechanic Powers," which was reprinted in Part I. (*and last*) of the "*Mathematical and Philosophical Tracts*," published by Glendinning in 1801.

Art. XVI. An easy method of determining *experimentally* the Curve which a shall describe in its Flight. By Reuben Burrow.

Art. XVII. Additional Remarks on the Equation of Payments. By Reuben Burrow.

⁎ The Equation of Payments appears to have attracted considerable attention during the publication of this periodical, for Articles I., XI., and XVII., are entirely devoted to its consideration; and it also forms the subject of several questions both in this work, the Old *Ladies' Diary*, its "*Supplement*," and Whiting's *Scientific Receptacle*. In Art. I. of this work, Mr. Dalby offers an improvement of Malcolm's method, and deduces formulæ applicable to both *simple* and *compound* interest. Mr. Burrow takes up the discussion in Art. XI., and after deducing formulæ for both cases, remarks that since, "*Mr. Professor Hutton, F.R.S.*, has thought proper to condemn Kersey's rule as *false*, and to give the preference to a rule of *Mr. Malcolm's*, which he says is '*the only true one*,' it will not be improper here to show that *Malcolm's* and *Kersey's* are in effect the same, and that both agree with the foregoing rule, when compound interest is allowed." This he accordingly does, and after deducing the conclusion "that the common method of computing the equated time at simple interest is true, and that Kersey's rule is also true in compound interest;" winds up this paper by observing that Mr. Dalby had arrived at the same results independently, so that "*Professor Hutton's* assertions to the contrary, have just as much validity as *Dr. Horsley's* confirmation of *Stewart's* theory of the *sun's* distance; and the same answer which *Mr. Lunder* gave the *Doctor* is equally applicable to the *Professor*." Mr. Todd next appears as the proposer of Ques. 22, deducing from his solution that "Malcolm's method always gives more money to the creditor than could be made by receiving the debts as they become due." In the *Diary* for 1779, Mr. Burrow re-appears, apparently in self-defence, and introduces his "Additional Remarks" by stating that in consequence of "*The ingenious and learned Professor Hutton, Esq.*, having in the last edition of his Arithmetic, introduced a new and very polite method of confuting the arguments advanced in the *Diary* for 1777, on the subject of equation of payments; *viz.*, by representing the writer as a '*malicious defamer and an ignorant pretender*;' and notwithstanding the authority of so considerable a personage, there being still many people so obstinate as to retain their former opinion, that *abuse* is not *demonstration*, and that false

reflections on a person's moral character should have no place in matters of science—I have, therefore, in respect to such of my readers, taken the liberty of giving some further confirmations of what I before advanced, and also to show that the rule which the 'ingenious professor' affirms to be '*the only true one*' is not only false, but even false on his own principles; that both Kersey's principle and Malcolm's, when rightly applied, bring out exactly the same conclusion, as the old method which he has reprobated, and that the *learned professor's* mistakes arise from not knowing how to find the amount of a sum of money for a given time at simple interest." After an investigation from which Mr. Burrow infers that, "both Kersey's and Malcolm's principles, *rightly applied,* agree exactly with the old method," he proposed a method "to prove the Professor's conclusion false," and dismisses the controversy by observing that "it is not worth while to bestow any further confutation on a method so grossly and palpably false; and therefore, as the errors remain uncorrected in the two last editions of his book (viz., the *third* and *fifth*), I shall only advise the learned professor to correct them in his next *seventh* edition."

Art. XVIII. Miscellaneous Problems and Solutions. By Reuben Burrow.

*** Prop. I. of this paper determines the position of the resultant of any three forces in the same plane. Prop. II. finds the *ratio*, from having the *directions* of any three forces given in equilibrium. Prop. III. requires the pressure upon each of three hemispheres placed upon a horizontal plane, when a fourth sphere is sustained by them. Prop. IV. gives "three spheres placed on a horizontal plane sustaining a fourth," and requires "the force sustained by each." The 329th question of the *Ladies' Diary* for 1750 is a particular case of this problem, and an elegant solution by Mr. Lowry may be seen in vol. ii., pp. 40, 41, *Leybourn's Edition;* the same gentleman had previously considered the subject after a different method in vol. ii., p. 307 of the *Old Series* of the *Mathematical Repository.* Ques. 1763 of the *Lady's and Gentleman's Diary* for 1847 resolves the same question, when friction is taken into account. Prop. V. relates to a body falling down "two planes inclined to each other;" and Prop. VI. finds the velocity acquired by a body descending through "any number of planes given in position." A note at the conclusion of the paper asserts that *James Gregory* was the author of "a small treatise, published at Glasgow in 1672, under the name of *Patrick Mathers,* entitled '*The Great and New Art of Weighing Vanity,*'" in which several mistakes in the usual demonstration of the last proposition are pointed out.

Art. XIX. No article appears under this head, but it would seem that it was intended to include the Rev. W. Crackelt's solution to the Prize Question of the preceding year.

Art. XX. Additions and Corrections to the preceding Diaries. By Reuben Burrow.

*** The corrections consist chiefly of press errors, and the substitution of *correct* for a few former *erroneous* paragraphs. The Additions contain a method of constructing the plane triangle when "the perimeter, the vertical angle, and the rectangle of the segments of the base made by the point of contact of the inscribed circle" are given; a note referred to in Art. XIV.; and "a correct answer to the 12th question, by Mr. Jeremiah Ainsworth," in which it is "required to determine the odds, that no one of the four players has five or more trumps in any one deal, at the game of whist."

Art. XXI. A Method of finding the common Expression for the Radius of Curvature. By E. C.

Art. XXII. A new Method of determining the Longtitude of any plane whose Latitude is known, where the beginning, end, or any number of digits of a solar eclipse; or the immersion, emersion, or appulse of a star by the moon has been observed. By J. Keech.

Art. XXXIII. Remarks on the Universal Measure. By J. A.

Questions.—The total number of questions proposed in this periodical was 171, of which solutions were given to 157. Of these 4 belong to Arithmetic; 3 to Mensuration; 2 to Series; 3 to Chances; 22 to Algebra; 16 to the application of Algebra to Geometry, &c.; 15 to Trigonometry; 16 to Fluxions; 19 to Mechanics; and 53 to Geometry, Geometrical Analysis and Construction, &c.;

the rest were either omitted from necessity, or were sufficiently evident from previous solutions.

Most of the questions appear to have been selected with considerable care, and in the earlier numbers of the work especially, were well adapted to test the varied abilities of the Editor's numerous and able correspondents. The geometrical portion of the work is well sustained, nor will its preponderance afford any reasons for regret, since it preserves to us many valuable researches of those geometers of the last century, who may truly be said to have caught the mantle of Simson. In several of the first numbers the intended Editor and his correspondents laid the foundation of several inquiries which have since been found very prolific in the hands of succeeding geometers both of our own and other countries. Mr. Dalby, under the signature of "*Caput Mortuum*," and also in his real name, furnished the work with a series of investigations of singular ability and elegance; nor must we omit to particularize the contributions of Lawson, Crackelt, John Burrow, Sanderson, Moss, and last, but not least, those of Jeremiah Ainsworth, the friend and Tutor of Wolfenden; all of whom enriched the earlier portion of this periodical with many valuable and original questions and solutions.

Ques. 11, gives "the line bisecting the base, the difference of the sides, and the difference of the angles at the base," to determine the triangle. The question had previously been proposed by Mr. Thomas Hulme, as No. 24 in the "*Mathematician*," and was there solved algebraically by Mr. John Turner. It was here re-proposed by the Rev. W. Crackelt, who gave a *geometrical* construction to the problem, not only when the *sum*, but also when the *difference* of the sides is given.

Ques. 21, by Mr. Thomas Moss, is perhaps the most important question ever proposed in an English periodical, since it approaches more nearly to a *formal* statement of some of the leading properties of the *complete quadrilateral* than any other we have seen. A particular case of the general problem was proposed by Mr. R [ollinson] as the 14th Question in the *Mathematician*, and the property was afterwards *generalized* by Mr. Davies in Question 18 of *Clay's Scientific Receptacle*; but the method of investigation there used, does not seem well adapted for evolving the many interesting properties of the figure, and is certainly much inferior to that used by Mr. John Burrow in his discussion of the question under consideration. Indeed, Mr. Burrow's investigation, except as to *form*, differs very little from the present methods of treating these subjects, and, independently of its intrinsic merits, deserves greater publicity than it has hitherto obtained, since it establishes, beyond a doubt, that to an almost *unknown* correspondent in an equally *little known* English periodical, we are indebted for, at least, the re-discovery of the fundamental theorems in one of the most interesting fields of modern research, and which has since been so effectively and extensively cultivated by Carnot, Chasles, and our own Professor Davies.

Question.

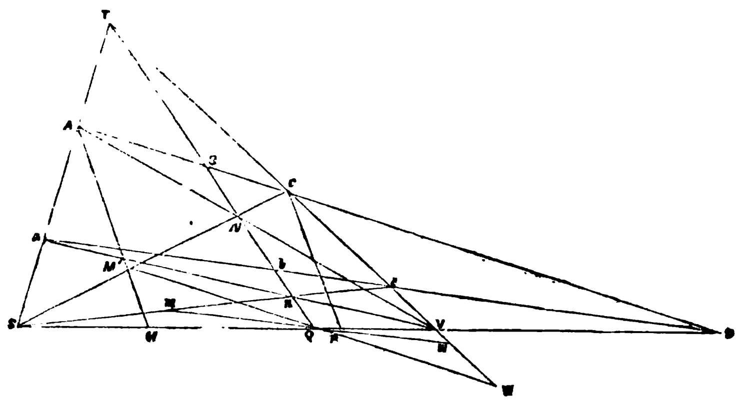
"If from the extremities, S and V, of the base of a triangle, STV, two lines be drawn through a given point, N, meeting TV and ST in C and A, and the line, TN be joined, meeting AC in B; also if from A and C parallel lines be drawn meeting the base in M and P, then will AB : BC : : AM : CP;—required the demonstration."

Though in accordance with the practice of the times, the preceding is enunciated merely as a property of the triangle, it is obvious from an inspection of the diagram (next page) that TASNVCT is the *complete* quadrilateral whose three diagonals are AC, TN, and SV respectively, and hence any properties proved to be true for the case of the triangle, are equally true with respect to the corresponding parts of the more general figure. Now, in the earlier portion of Mr. Burrow's demonstration, it is shown that

$$AB : BC :: AD : DC,$$
$$SQ : QV :: SD : DV;$$

or the diagonals are harmonically divided in B, Q, and D. This is obviously the same as the "celebrated theorem" contained in Prop. IX. of the article "Transversals" in *Davies's Hutton*, and also corresponds to Prop. VI., pp. 74—6 of *Carnot's* "*Essai sur la Théorie des Transversales*," where the property appears to have been first formally announced. The next portion demonstrates

that $Qm = Qw$, which is equivalent to (1) Theorem 99, Vol. I., *Davies's Hutton*, where the property is thus expressed:—"If a straight line be divided harmonically, and from the four points of section, straight lines be drawn through any point in the same plane, then (1) any straight line drawn parallel to those four lines will be bisected by the other three." In the concluding portion, it is further shown that "if any two lines, SC and VA, be drawn, intersecting the line TN in N, and cutting the sides in A and C; then if AC be drawn cutting SV produced, it will cut it in the point, D, where *ac* cut it before;"—a property which is obviously the *converse of Carnot's* "*Corollaire*" to the proposition previously cited, and which is also contained in Prop. IX. of *Davies's Transversals*. Three corollaries are added to the demonstration, in the first of which it is stated that "if TS, TV, be two lines given in position, and D any given point,



and if any lines DS, D*a*, DA, &c., be drawn from D, cutting the lines TS, TV, in the points *a*, A, *c*, C, &c., and if the points S*c*, V*a*, SC, VA, be joined, then the *locus* of all their points of intersection, *n*, N, &c., will be a right line;"—which again corresponds to the concluding remark in *Carnot's* "*Corollaire*." The second corollary announces that "if TS, TQ, TV, be three lines, and D a point taken, so that SD : DV :: SQ : QV; then if any line whatever, DA, be drawn cutting the lines aforesaid, AB : BC = AD : DC, &c."—which corresponds to "Théorème VII" of *Carnot's* "*Essai*," and also to (2) of Theorem 99, Vol. I., *Davies's Hutton*. In the third corollary we find that "if Q*m*, QM′ be drawn parallel to D*a*, DA, cutting S*c*, SC, in *m*, M′; then will the *locus* of all the points, *m*, M′, be a right line *parallel* to TV, and Q will be a point equally distant from TV and *m* M′"—a property we have not met with elsewhere.

Much more might evidently be added on the subject of this important question, but we here desist, judging that enough has already been adduced to justify the remarks we ventured to offer at the commencement of the present note; we may, however, be permitted to invite the reader's attention to the works above cited, but especially to *Hutton's* Course (which is more readily accessible), in the first volume of which he will find abundant proofs of the fecundity and *utility* of the principles above noted, as exemplified in the interesting article on "*Practical Geometry in the Field*."

Ques. 24 is the same as No. 337 of the *Gentleman's Diary*, where it was proposed by Mr. Tilney, and answered *algebraically* by Messrs. Hartley and Robinson. It was here re-proposed by the Rev. W. Crackelt, and good *geometrical* solutions were given to it by Messrs. Ainsworth, Crackelt, and Sanderson.

Ques. 28 is re-proposed by Mr. William Hardy from the *Palladium*, in which work it appears as Ques. 619, and has previously been noticed in the *Mech. Mag.*, vol. L., p. 475. An elegant *geometrical* solution is given in the *Diary* by Mr. Ainsworth.

Ques. 37 is proposed and answered by Mr. Dalby. It gives "two plane angles, to find another plane angle, as that the three being joined, the two first may make a given angle." The proposer observes that "this question . . and its reverse, being equally necessary," he will "give solutions to both; as they may sometimes happen to be useful to the practical workman."

Ques. 38 is by Mr. Reuben Burrow, and gives "two curves of any kind in position; required to draw a line parallel to a line given in position, so that the part intercepted between the two curves may be of a given length." This question is obviously a *generalization* of the *Problem of Inclinations*, and as it was proposed in 1778, appears to have been the *germ* whence sprung the author's "*Restitution of the Geometrical Treatise of Apollonius Pergæus on Inclinations*," published in 1779. After the solution of the question, Mr. Burrow states that "this problem will be found of great use in resolving and determining the limits of many geometrical questions;" two examples of which he afterwards subjoins. Ex. (1) corresponds to the limiting cases of Problem IV. in the "*Restitution*," and though (in the copy from which we quote) some quaint critic has observed in a MS. note, that "this 4th proposition does not properly belong to the subject, being, in fact, *totally foreign* to it," there appears to be sufficient *relationship* existing to warrant its insertion in the "*Treatise*." The *third* proposition of the "*Restitution*" is also objected to by the same MS. annotator, who justifies Dr. Horsley's *omissions* on the ground that "*they were not considered by Apollonius;*" the author however terms both the *third* and *fourth* "*very material propositions*," and he appears to have sufficient reasons for forming this opinion.

Example (2) corresponds to Problem V. of the "*Restitution;*" *the same demonstration and almost the lettering of the diagrams being preserved in both places.* "This excellent construction (says the MS. critic) contains the whole of Dr. Horsley's Book I., Prob. 1, 2; Book II., Prob. 1," and Mr. Burrow observes that "the method is exactly the same whatever position P may take." When the two circles coincide, "the construction is then, that particular case, which makes the 44th and 45th propositions in p. 192 of Gregory St. Vincent, which Mr. Horsley has, with his usual acknowledgment (the MS. critic here adds "*none at all*"), made the first and second propositions of his Restoration." In the *Diary* itself Mr. Burrow observes that Ex. (2) "serves for all that *Dr. Horsley* has split into a dozen cases, and filled *eight* pages of his 'Book of Inclinations' with; and here it may not be amiss to observe that the limits of the problems contained in that book, may be determined in a much simpler manner than that used by the *Doctor*, from this principle, viz., *that if the rectangle of two quantities be given, their sum will be the least when their difference is least, and their sum greatest when their difference is greatest.*" The portion given in *italics* forms the lemma to Mr. Burrow's "*Restitution*," from which the whole of the limitations to the problems are determined; its utility in these inquiries may have been one reason which induced the author to publish his valuable tract.

Ques. 63 is proposed by Reuben Burrow, and gives "three altitudes of the sun, and the two intervals of time to find the latitude of the place, the sun's declination, &c., by construction:" it was answered geometrically by "Archimedes" and Mr. Ainsworth. Solutions to the same and several kindred problems, by Euler and Bernouilli may be seen in a paper from the *Petersburgh Commentaries*, communicated by Mr. Michael Fryer, and reprinted in No. 18 of the *Gentleman's Mathematical Companion*, and also in the answers to the Prize Question (529) in No. 24 of the same work, by Messrs. "A. B. L.," Gomperts, Stratford, and Wright.

Ques. 71 gives "the base and vertical angle, to construct the triangle, when the rectangle under the line bisecting the vertical angle and the difference of the sides is a maximum;" it was proposed by Mr. Wolfenden, and was solved by Mr. Ainsworth with the assistance of the conic sections. Mr. Wolfenden suppos-

ing it capable of a geometrical solution, re-proposed it as Ques. 400 in the *Gentleman's Mathematical Companion*, where may be seen an elaborate investigation, which is usually considered the masterpiece of the late Mr. John Butterworth. (See *Mech. Mag.*, vol. L., p. 388.)

Ques. 79 relates to the pressure of the wedge of earth behind a revetment wall, and was proposed in order to point out some mistakes made on this subject by Mr. Muller, in his "*Practical Fortification*," but the editor's remarks were all that appeared on the question. Lieut. Lambton afterwards supplied the necessary corrections in his "*Observations on the Theory of Walls*," reprinted in No. XI. of the *Gentleman's Mathematical Companion*, and the subject is also ably and fully treated in Mr. Hann's "*Practical Mechanics*," pp. 209—223.

Ques. 75 gives the angles, the perimeter, and the area, to construct the trapezium; it forms Problem 18 of *Newton's Arith. Universalis*, where an elegant *algebraical* solution is given. Mr. Dalby constructs the problem *geometrically*—deduces the two trapeziums which answer the conditions, and infers the case when the *area* of the trapezium is a maximum.

Ques. 78 is one of those proposed by Dr. Wallis to Mons. Fermat, and contains the property that, "if from the vertex of an equilateral triangle inscribed in a circle there be drawn a line to any point of the opposite circumference, its length will be equal to the sum of the two chords inflected from the same point to the extremities of the base." Neat solutions are given by Dr. Pemberton and Mr. Ainsworth, and the property also forms Prop. 13, B. IV., *Leslie's Geometry*.

Ques. 87 gives "the base and the vertical angle, to determine the triangle when the difference of the perpendicular and the line bisecting the vertical angle is a maximum;" it was proposed by Mr. Wolfenden and solved by Mr. Nicholson on Fluxional Principles, but this not meeting the wishes of the proposer, the question afterwards appeared as No. 136 of *Whiting's Delights*, to which a solution was given by the proposer, by the method of Prime and Ultimate Ratios. (See *Mech. Mag.*, vol. L., p. 388.)

Ques. 90 derives an easy demonstration of Euclid 36, 3. by "way of corollary to" Euclid 35. 3; and Ques. 92 supplies an *algebraical* solution to No. 768 in the Old "*Ladies' Diary*" for 1781. A very elegant *additional* solution to the same question is given by Dr. Wallace, in pp. 377-9, Vol. IV., *Leybourn's Diaries*.

Ques. 93 was proposed by the Editor as the Prize for 1783. It is well known as "*Towneley's Proposition*," which appeared in the "*Phil. Transactions*" for 1671, and has since been treated by Dr. Wallace in his "*Geometrical Theorems and Formulæ*," under the name of "*Hipparchus's Problem*." The question appears to have been here re-proposed, on account of its usefulness in geodetic operations, and elegant geometrical solutions are given in the next number by Messrs. Pringle and Nicholson.

Ques. 102 is the well-known *poetical* one respecting the "tinker and his kettle," which first appeared as No. 17 in the *Ladies' Diary* for 1711; *it was here re-proposed as a new question by* Mr. William Henry!

Ques. 131 is the Prize for 1786, and was answered by Salfordoniensis (Clarke?) without a competitor. It gives "ACB any diameter of an ellipse, *except an axis*; to divide its periphery, *geometrically*, into two parts, AD, DB, such that their difference may be exhibited in *finite* terms." The question is well known as the "Theorem of Fagnani," and appears from a "Scholium" at the close of the solution, to have been considered by Mr. Landen in his "*Memoirs*," and also by Mr. Clarke in the "Supplement" to his translation of "*Lorgna's Series*." The subject was subsequently taken up by Sir James Ivory, who generalized and extended the property to the other conic sections, in an able paper contained in Vol. I., part 2, pp. 9—15 of the New Series of *Leybourn's Mathematical Repository*. Professor Davies has also treated the "Theorem" very elegantly in pp. 514-5, Vol. II., of his edition of *Hutton's Course*.

Ques. 157 includes 104, 115, as particular cases. It is the Prize for 1788, and gives the *weight* of a ball, the *latitude* of the place, and the *radius* of the earth, to find the *height* to which it must be projected so as to weigh only half as much,

and also *its deviation from the place of projection* on its return to the earth. A similar question to this was proposed by the Rev. William Putsey, as No. 788 in the "*York Courant*," to which solutions were given by Mr. William Tomlinson, then editor of the mathematical department, and Mr. Richard Spruce, of Leeds. Neither of these solutions appearing satisfactory to the proposer, he addressed a short note to the Editor, expressive of his dissatisfaction, which led to an amusing controversy between himself and "Collegiatus," of York; but, as is too frequently the case, *personal ridicule* soon took the place of *logical argument*, and the subject was left without a satisfactory elucidation. An interesting discussion on this subject might be formed by taking in connexion with these questions No. 206 in the *Ladies' Diary*; Problem 198, *Emerson's Algebra*; a valuable paper by Dr. Clarke in pp. 279-286, Vol. IV. *Leybourn's Edition* of the *Ladies' Diary*; and two papers by an anonymous correspondent and Dr. Hart in the third and fourth volumes of the *Cambridge and Dublin Mathematical Journal*.

Contributors. — The contributors to this periodical were mostly men of distinguished abilities; many of whom afterwards attained to great eminence in the literary and scientific world. Amongst the most noted may be enumerated Messrs. Abbatt; Ainsworth; Andrews, the noted astronomical calculator for the Stationers' Company; Arnold; Backhouse; Badger; Barker; Beck; Bonnycastle, afterwards Professor in the Royal Military Academy; Brown; John Burrow; Reuben Burrow, editor of this *Diary*, and author of the "Restitution," &c., &c.; Clarke; Crackelt, translator of *Mauduit's Trigonometry*, &c.; Crosby; Isaac Dalby (*Caput Mortuum*), afterwards professor of mathematics and author of the well known "Course of Mathematics;" Edwards; Farey; Fininley; John Hampshire, afterwards editor of the *Gents. Math. Companion*; Hatton; Hornby; Keech; Keith (Thomas), author of Trigonometry, &c., &c.; Rev. John Lawson, author of Apollonius on Tangencies, Synopsis of Data, Geometrical Analysis of the Ancients, &c., &c.; Mabbott, Maucuniensis (John Holt); Merrit; Moody; Thomas Moss, author of "gauging," &c.; Moulsdale; Nield; Neutoniensis; Nicholson; Ogle; Pepys; Pringle; Purvis; Robins; Samuel Rogers, author of "Italy," &c., &c.; Rowe; John Ryley, afterwards editor of the *Leeds Correspondent*; Salfordoniensis (Clarke?); Sanderson; Swift; Todd; Walker; Watson (Colonel); Waugh; Wheldale (Lieut.); Wilkins; Wolfenden; &c., &c., &c.

Publication. — The publication took place annually, about November in each year. The first number was "printed for T. Carman, No. 65, St. Paul's-church-yard; and G. Robinson, at No. 25, Paternoster-row;" but the succeeding numbers were "printed for T. Carman" *only*, "who after an expensive suit in law and equity, by the unanimous opinion of the judges of the Court of Common Pleas, dispossessed the Stationers' Company of their pretended exclusive privilege of printing almanacks, which they had usurped for two centuries,—a convincing proof that no unjust monopoly will ever stand the test of an English Court of Justice.

It ought to have been remarked in addition to what is stated on the subject of Prop. X., p. 297, that "the *figure* used by Burrow, Lowry, and the *Student*, was first given (with fewer lines) in Jones's *Synopsis Palmariorum Matheseos*, p. 244, who professes to have received it from Dr. Halley, and hence it has been very appropriately termed "*Halley's Diagram*," by Professor Davies, in pp. 49—50, of the Appendix to the *Ladies' Diary* for 1836. The figure in the "*Horæ Geometricæ*" is an extension of Halley's Diagram, all the sides of the triangle being treated as preceding writers had treated the base only; and its properties have been fully developed in the "Horæ" by Messrs. Davies, Rutherford, Lowry, Weddle, and Elliott. My best thanks are due to the correspondent who pointed out this omission.

THOMAS WILKINSON.

Burnley, Lancashire, October 1, 1849.

Errata.

Page 293, col. 1, line 7 from bottom, for *provismatized*, read *porismatized*.

Page 294, col. 1, line 9 from top, for *Barrow*, read *Burrow*.

Page 295, col. 1, line 20 from top, for *religna*, read *reliqua*.

Page 296, col. 2, line 8 from top, for *Simpson*, read *Simson*.

Page 296, col. 2, line 14 from top, for *Saunderson* read *Sanderson*.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Jamieson, of Ashton-under-Lyne, Lancaster, machine maker, for certain improvements in looms for weaving. October 4; six months.

Charles Attwood, of Tow-law Iron Works, near Darlington, Durham, Esq., for an improvement or improvements in the manufacture of iron. October 5; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery for planing, tongueing, and grooving boards or planks. (Being a communication.) October 5; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in the manufacture of pipes or tubes. (Being a communication.) October 5; six months.

Henry Watson, of Newcastle-upon-Tyne, brass founder, for improvements in valves and cocks. October 12; six months.

Robert Larkin, of Ardwick, Lancaster, machinist, and William Henry Rhodes, of Openshaw, Lancaster, mechanic, for certain improvements in machinery, and for preparing, spinning, doubling, and weaving cotton and other fibrous substances. October 12; six months.

Peter Armand le Comte de Fontainemoreau, of South street, Finsbury, for improvements in spinning fibrous substances. (Being a communication.) October 12; six months.

Joseph Lowe, of Salford, Lancaster, surveyor, for certain improvements in grates or grids applicable to sewers, drains, and other similar purposes. October 12; six months.

Michael Titch, of Chelmsford, Essex, patent salt manufacturer, for improvements in baking bread, biscuits, and other matters, which improvements are applicable for drying goods. Oct. 12; six months.

Cornelius Bonell, of Kempsey, Worcester, engineer, for certain improvements in rotary engines to be worked by steam or other means, and also in the construction of carriages, vessels, or other vehicles to be worked or propelled by the said improvements in rotary engines or other motive power, and for the machinery to be connected therewith. October 12; six months.

James Banister, of Birmingham, manufacturer, for a certain improvement or certain improvements in tubes for locomotive and other boilers. October 12; six months.

George Alois Ringeison, of Essex-street, Strand, Middlesex, chemist, for a composition or preparation for destroying vermin. Oct. 12; six months.

Charles Rowley, of Newhall-street, Birmingham, button manufacturer, for certain improvements in apparatus for weaving, and in articles to be attached to dresses. October 12; six months.

John Bury, of Torkington, Lancaster, railway contractor, for certain improvements in the construction of chairs for railways. Oct. 12; 6 months.

John Christophers, of Heavitree, Devon, formerly merchant and shipowner, for improvements in naval architecture. October 12; six months.

Thomas Lightfoot, of Broad Oak, Lancaster, chemist, for improvements in printing cotton fabrics. October 12; six months.

William Stedman Gillett, of Wilton-street, Grosvenor-place, Esq., for improvements in packing pistons, stuffing-boxes, slides, and other parts of machinery, and in forming bearings, and in making cylinders and other forms of metal. Oct. 12; 6 months.

Conrad William Finzel, of Bristol, sugar refiner, for improvements in the processes and machinery employed in and applicable to the manufacture of sugar. October 12; six months.

John Mercer, of Oakenham, Lancaster, gentleman, and William Blythe, of Holland Bank, in the same county, manufacturing chemist, for improvements in certain materials to be used in the process of dyeing and printing. October 12; six months.

Jules le Bastier, of Paris, gentleman, for certain improvements in machinery or apparatus for printing. October 12; six months.

Joseph Johnson, of Huddersfield, York, bricklayer, and Joe Cliffe, of the same place, ironfounder, for improvements in furnaces or in the means of consuming smoke. October 12; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Oct. 4	2046	John Morland & Son	Eastcheap	Floriform parasol.
5	2047	Walter Morgan	Liverpool	Wire-fastened circular brush for cleaning boilers and other tubes.
„	2048	Isaac Green	Victoria-place, Euston-square	Wind guard.
6	2049	George Alexander Copeland	Pendennis Castle, Falmouth	Safety cartridge for blasting purposes, in mines, quarries, and other situations.
8	2050	John Hynam	Princes-square, Finsbury	Metal box with rounded corners at ends and bottom, to be opened by a horizontal groove slide (inverted).
„	2051	William Gray, Charles Christopher, and Thomas Barratt	Liverpool	Cooking apparatus for ships.
„	2052	James Townsend	Birmingham	Improvements on or addition to valves for air-guns.
10	2053	W. Thicthener	Union-terrace, Bagnigge-wells-road	Solid impulse lever.

CONTENTS OF THIS NUMBER.

☞No Specifications of English Patents Enrolled this Week.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1367.] SATURDAY, OCTOBER 20, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

SWAN'S PATENT IMPROVEMENTS IN HEATING APPARATUS.

Fig. 1.

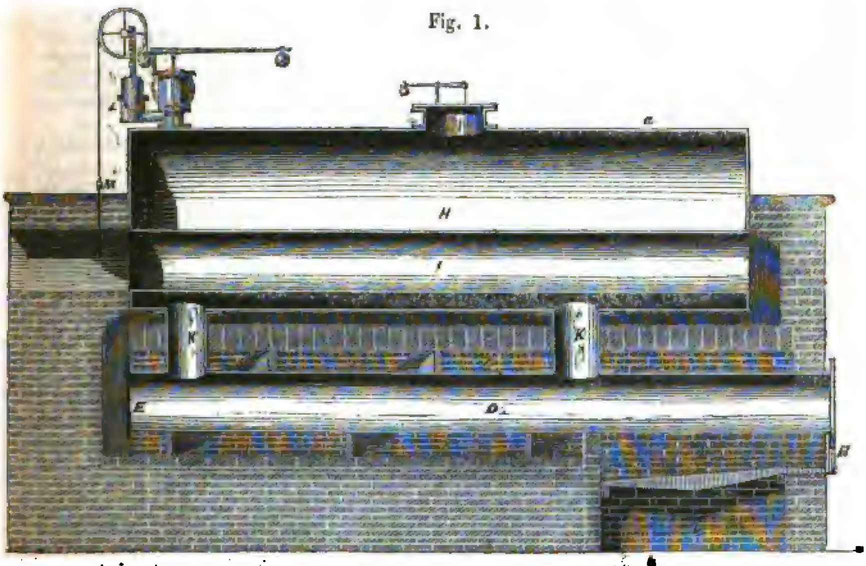


Fig. 2.

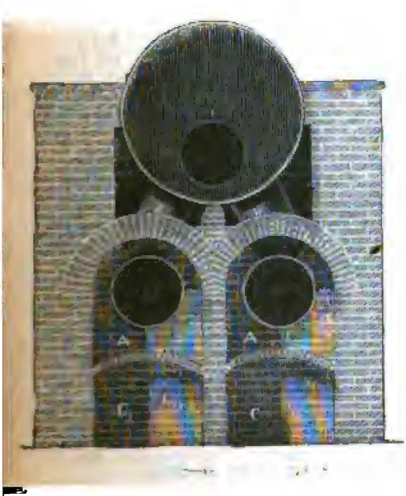
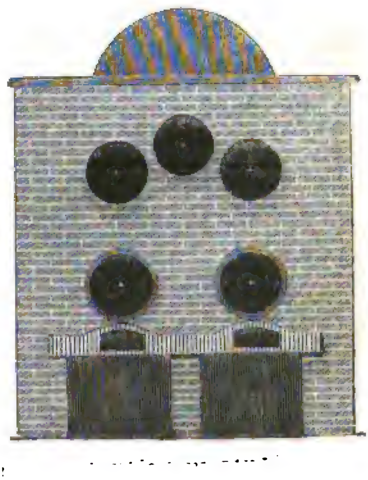


Fig. 3.



SWAN'S PATENT IMPROVEMENTS IN HEATING APPARATUS.

(Patent dated March 14. Specification enrolled September 14, 1849. Patentee, Alexander Swan, of Kircaldy, Manufacturer.)

I. Mr. Swan's improvements have, firstly, for their object, the economizing of fuel in the generation of steam, in the evaporation of fluids, and in the distillation of coal and other like substances. Two of his exemplifications will suffice to show the general system on which he proceeds:—

Figs. 1, 2, 3, and 4 exemplify the application of these improvements to an ordinary steam boiler. Fig. 1 is a longitudinal section of the boiler, furnace, and appendages. Fig. 2 is a cross section on the line, *ab*, of fig. 1; and fig. 3 is an end elevation. A, is the furnace; B, the furnace door; C, the ash-pit; D, a small cylindrical boiler, which occupies a place in the interior of the furnace, and is prolonged backwards to E, between which and the furnace, A, it forms the core around which a spiral flue, FF, is constructed. The heated products of combustion arising from the furnace are thus made to traverse over nearly the whole of the exterior surface of the boiler, D, before arriving at the flue, G, where they come in contact with the exterior surface of the boiler, H, and ultimately pass into the chimney by the internal flues, J. By this arrangement, the greater portion of the heat generated in the furnace is absorbed by the boiler and its contents before the gases enter the chimney. KK, are pipes which connect the boilers, D and H, together, and through which the steam and water have free course to circulate. L is an apparatus for regulating the draught through the chimney, according to the pressure of the steam inside the boiler. When the pressure increases, through a too great intensity of fire in the furnace, or from other causes, the regulating apparatus closes the damper, M, and slackens the fire, while, on the contrary, a decrease of pressure of the steam causes the regulator to open the damper. A view of this regulating apparatus, partly in section, is given on an enlarged scale in fig. 4. N, is an upright cylinder fixed on the top of the pipe, O, which last has free communication with the boiler; P, is a metal plunger, which fits loosely into the cylinder, N. At the bottom this plunger rests upon a diaphragm, O^2, of vulcanized caoutchouc or other suitable elastic substance capable of resisting the force of the steam, and at top it carries a rack, Q, which takes into a pinion, R, affixed to the shaft of a grooved pulley, S. The damper, M, is suspended from a chain on the pulley, S, and counterpoised by a weight, T, upon the opposite side of the pulley, which weight also acts against the pressure of the steam on the diaphragm. When the steam increases beyond the pressure to which the weights of the different parts are calculated, it raises the plunger by pressing upon the elastic diaphragm, and acting thereby upon the pulley, S, causes the damper to descend. A reverse action takes place when the pressure of steam is reduced.

Fig. 5 represents this system of heating applied to the evaporation of lees, AA, are two cast-iron tubes, which are connected together at one end by a pipe, B, and at the other end communicate with a cistern, C, through the pipes D and E. The uppermost of the tubes A is wholly enveloped by a spiral flue, but the lowermost occupies a place partly in the furnace F, and partly in a spiral flue G. The heated gases of the furnace after having circulated around the lower tube, pass up around the pipe B, and circulate about the upper tube, escaping at H. The lees in the lower tube A as they become heated, ascend into the upper tube through the pipe B. The increase of heat causes the lees to be ejected from the upper tube A through the the pipe D, into the cistern C, in which there is a division plate, againstwhich the lees are forced, which causes a separation of the steam from them, the steam escaping by the pipe I, while the lees descend into the lower tube A, by the pipe E. This circulation of the lees is continued until it has been sufficiently evaporated, when it is let off by a pipe at K.

The lees are introduced through a pipe at L. MM, are the handles of the scrapers or tube cleaners. Fig. 6 is a longitudinal section, and fig. 7 is a cross section of a tube for evaporating lees. It is fitted inside with a moveable division-plate AAA, with level flanges on its surface, as represented in section. The lees are admitted at B, circulate between the flanges and escape at C, in a recovered state. The heat is to be applied to the external surface of the tube by means of a furnace and spiral flue, as has been described in reference to fig. 5.

II. Mr. Swan shows, secondly, how his spiral flue system may be advantageously applied to the heating of air for drying purposes; such as the drying of yarn cloth, paper, grain, &c., and also to the heating of houses.

For claims, see *ante*, *p*. 282.

Fig. 7.

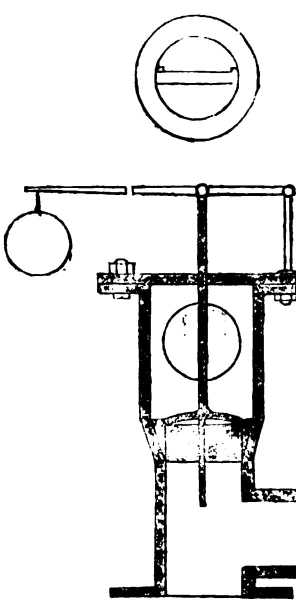


Fig. 4.

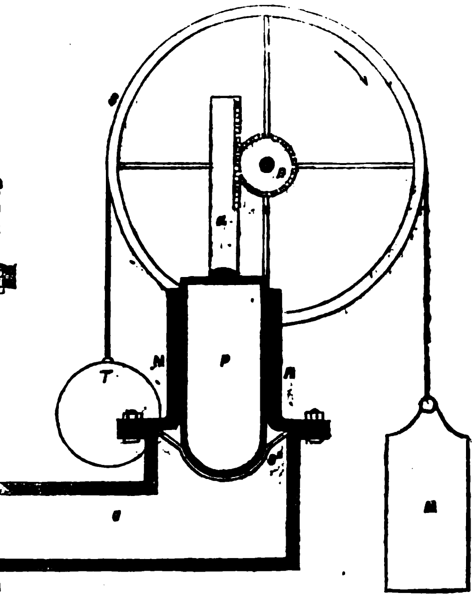


Fig. 6.

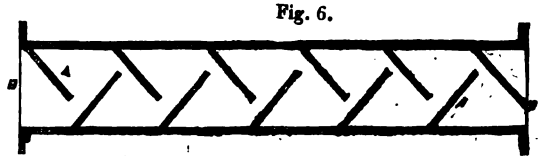
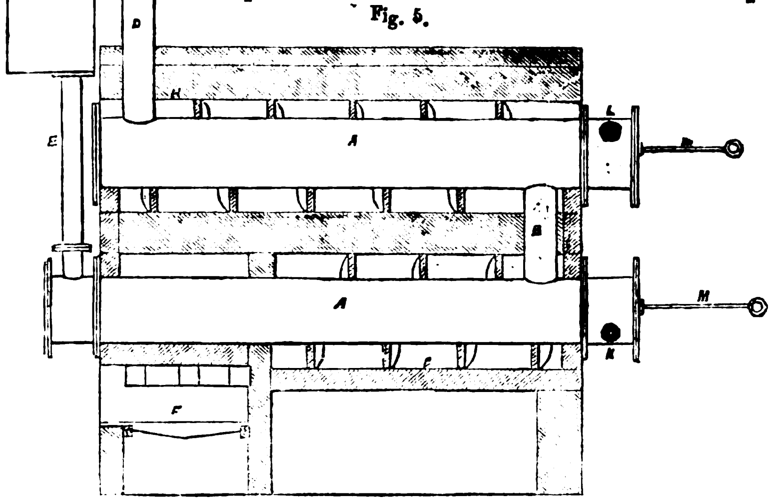


Fig. 5.



THE "ORKNEY" OR "GALLOWAY ENGINE."

Sir,—Seeing in your Magazine of October 13, a letter by a Mr. G. Houldsworth, stating "that I knew nothing of the Orkney engine until *he* had put it into a tangible form," I beg to give this unscrupulous statement the fullest contradiction, inasmuch as the drawing from which I took my idea was in my possession some years before I ever saw Mr. Houldsworth. I have never denied that Mr. Galloway's talent first brought the thing into a certain working order, but I am not aware that Mr. Houldsworth ever did anything beyond the carpenters' work. The public will think it remarkable that with this extraordinary combination of talent in Mr. Galloway's office, it should be left to the Orkneys and their friends to beat the *Mulls* of Galloway. You condemned *me* in your Magazine of October 6, for calling the engine by my family name. I have already stated that Mr. Galloway was *the first to do this*, and if you require any assurance of the fact you shall see it in his own hand-writing.

The *Mull* of Galloway would be objectionable from the very great number of *wreaks* connected with the name.

Numerous other competitors will doubtless arise in this matter, such as the smith who made the bolts, &c., but I shall not trespass further on your columns. We all know that

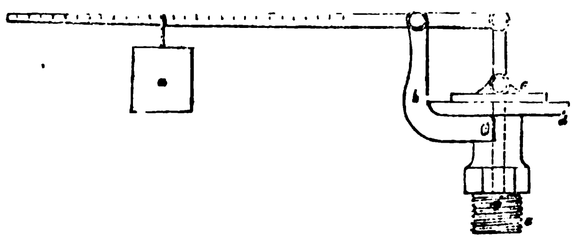
> "Sev'n proud cities, laid claim for Homer dead,
> Through which, the *living* Homer begg'd his bread."

Comparing small things with great, such is precisely our case.

I am, Sir, yours, &c.,
W. Fitzmaurice.

Dover-place, October 16, 1849.

AN IMPROVED PRESSURE INDICATOR.



Sir,—As many engineers have been much annoyed by the uncertain action of their pressure indicators (manometers and piston indicators), the first requiring a correction for the temperature of the air, and the last from friction and unequal expansion, I take the liberty of sending a sketch of one that I have constructed, which, as far as I have used it, seems to answer the purpose well.

Clement Désormes showed that when steam under high pressure escapes through a pin hole in a plate, and a flat disc is brought close to this plate, the plate and disc are made to adhere. This, then, is the principle on which I have made my pressure indicator. The cause of this I need not here explain, as your readers, if you be kind enough to insert this communication in your valuable Magazine, will, I think, easily understand it. I am, Sir, yours, &c.,

John P. Fraser.

Drawing Office, Swindon Works, Oct. 8, 1849.

Description.

a is a weight, which, by sliding outwards or inwards on the arm of L, a lever of the first order, supported by the prop, *b*, an equilibrium may be obtained, and the index then read.

c is a moveable disc, linked to the end of the lever, L; *d* is a plate, having a hole through it and the screwed part, *e*, which is made to fit the top of a gauge glass attached to any convenient part of a boiler or steam chest.

When steam is allowed to rush through the hole in the plate, *d*, the re-action produced by the pressure of the atmosphere causes the disc, *c*, to adhere to the plate. The relative sizes of the disc, *c*, and the hole in the plate, *d*, together with the weight required to separate the two (that is, the disc and plate) when the steam is allowed to act upon the instrument, determine the amount of pressure sustained by the boiler.

SIR JOHN F. W. HERSCHEL'S OUTLINES OF ASTRONOMY.*

George the Third's political sins, in our opinion, were many and great; but he was the steadfast and generous friend—the right royal patron of Herschel; and on this account, if we had the power, all his transgressions should be blotted out. Baron Fourier, in his biographical memoir of Sir William Herschel,† says that George the Third loved the sciences as the ornament of states, and as a pure source of glory and public prosperity. Such noble sentiments, practically illustrated as they were by that monarch's munificent patronage of Herschel, ought to emblazon his remembrance on learning's richest tablet, and procure for his memory the most distinguished niche in the temple of science.

Let other sovereigns treat literature with chilling neglect, and give no encouragement to science;—let them bestow all their favours and smiles on clever sketchers and accomplished actors;—let them prefer the dexterous use of the fingers, the agility of the feet, or the ephemeral charms of the well-drilled singer, to the more lasting beauties of mental labour;—they may frown on intellectual toil, and repulse the votaries of science: they may encourage foreign fiddlers and outlandish singers to make, and *carry away* princely fortunes—whilst native talent may starve. They can do all this; but literature and science will live. When such sovereigns (if such there be) have passed away, the labours of literary men, which they want minds to appreciate, and the inclination or the ability to understand, will go down to posterity and be admired by future generations, who will pass judgment on the stolid neglect that was evinced towards their authors, and wonder that sovereigns could have been so incomprehensibly short-sighted, as not to see that the whole of their power which is worth anything, rests on the mental efforts of their people, and that therefore it is a want of policy as well as a want of the more estimable qualities of the human heart, to discourage the cultivation of literature—to prefer the player to the poet, and stage trickery to science. Such sovereigns, if any such there be, will do well to bear in mind that George the Third by his friendship for Herschel has indissolubly connected himself with science—by that glorious friendship, he has inscribed his memory in the firmament. But more than this, the prince has been instrumental in making Great Britain celebrated wherever astronomy is cultivated, or science esteemed. Herschel's magnificent course of labours has established a kind of relationship between Britain and the stars. This well-grounded affinity will last for ever—it is as immortal as the spheres which it links together. Time can never disassociate the name of Herschel from the stars, nor can it ever separate that immortal explorer of the heavens from his patron prince.

"History," says Baron Fourier, "ought to preserve for ever the reply of this prince to a celebrated foreigner, who was thanking him for the large sums he had expended in furthering the progress of astronomy: '*I pay the expenses of war,' said the king, 'because they are necessary; as to those of science, it is agreeable to me to prescribe them—their object costs no tears and does honour to human nature.*'"

May eternal honour be the reward of every prince who so thinks and acts; may he, like George the Third, find a Herschel to embody his memory with the imperishable gems of the sky!

The splendid career of Herschel is so bright a beacon for guide, encouragement, and hope to all self-teaching students, and affords such a useful lesson for students of all kinds to contemplate, that we think a slight sketch of the services rendered by self-taught men to science, will neither be uninteresting nor out of place in the present article.

Baron Fourier's interesting memoir, referred to above, contains a narrative of some of the obstacles which Sir William

* "Outlines of Astronomy." By Sir John F. W. Herschel. 8vo. pp. 670. Cloth 18s.

† See *Edinburgh New Phil. Journal*, for October, 1827.

Herschel had to surmount in early life. Bath has the honour of having been his abiding-place when he first publicly appeared as a votary of science.

Arago, in his "Analyse Historique et Critique de la Vie et des Travaux de Sir William Herschel," (*Annuaire pour l'an* 1842, p. 254,) says, "Je profiterai de l'occasion pour rectifier une erreur dont l'ignorance et la paresse veulent ce faire une arme victorieuse, on qu'elles prèsentent tout au moins en leur faveur, comme une justification irresistible. On rèpète à satiété qu'un moment où il entra dans sa brillante carrière d'astronome, Herschel n'avait pas de connoissances mathèmatiques. J'ai déjà dit que pendant son séjour à Bath, l'organiste de la chapelle octagone s'était familiarise avec les principles de la géométrie et de l'algèbre; mais voici qui est plus positif; une question difficile sur les vibrations des cordes chargées de petits poids, avait été mise au concours en 1779; Herschel entreprit de la résoudre, et sa dissertation fut insérée dans plusieurs recueils scientifiques de l'année 1780."

To an English reader the expressions "avait été mise au concours en 1779," and "sa dissertation fut insérée dans plusieurs recueils scientifiques de l'année 1780," must be wholly unintelligible. We can supply an explanation. The following is the question: "The length, tension, and weight of a musical string being given, to find how many vibrations it will make in a given time, when a small weight is fastened to its middle and vibrates with it."

This was the Prize Question, in the *Ladies Diary* for 1779, proposed by Peter Puzzlem, a name assumed by Mr. John Landen. The question was answered in the following Diary by the proposer, by the Rev. Charles Wildbore, and by Mr. William Herschel, whose solution may be seen on p. 61, vol. iii., of Leybourne's Edition of the Diaries.

We have deemed it necessary to give this explanation, not only as forming an interesting link in our narration, but as a matter of justice to one of the most meritorious publications in this country, or perhaps in any other. Again and again, has it happened, that titled bookmakers and very lofty authors have adorned their pages, with beautiful propositions and problems, unscrupulously taken from this little modest publication without a hint at the source from whence they came. It is thoroughly dishonest thus to appropriate the offspring of others' brains, and to raise a fictitious credit upon it, without any acknowledgment. Arago's mystifying allusion, above quoted, is a piece of injustice of the same kind. If he obtained the information respecting the problem from the work itself he ought to have named it; if the information was supplied to him, his informant was neither candid nor trustworthy in suppressing the name of the publication. Herschel himself would have deprecated such an illiberal course. Very likely, the printing of that solution was one of the fortunate incidents which first encouraged him in the commencement of his career. However, almost all the authors whom the English student regards as household deities with respect to science, have enrolled their names in the list of Diarians; and scoff at that esteemed and valuable publication who may, its pages preserve the first scientific essay that Herschel gave to the world.

Arago was quite right in asserting, that the answer or memoir is a proof that the astronomer had, at that early period, formed an intimate acquaintance with very abstruse branches of abstract mathematics; the scholium was no indifferent specimen of the analysing powers of his mind.

In the same year in which this solution appeared, a memoir on the periodical star, Collo Cibi, was published in the Transactions of the Royal Society—the first of a series of memoirs in the same publication which, for variety, originality, and number, are perhaps unequalled in the history of science. "Ils forment," says Arago, "une des principales richesses de la collection célèbre comme sous le nom de *Philosophical Transactions*."

It is impossible in an article like this to

give even an outline of the astonishing achievements of this remarkable man. Arago has given a masterly analysis of them in the publication to which we have referred; his principal labours are also feelingly sketched in Baron Fourier's memoir. Although Sir William Herschel's fame commonly rests on astronomy, it will hardly be denied, that his celebrity is just as firmly and deservedly grounded on many other sciences. In attempting to form an estimate of his varied labours, it must be kept in mind that all his most remarkable discoveries and performances in astronomy were accomplished by instruments of his own manual construction. He penetrated into space immeasurably further than any human being had previously attempted to pierce; but he first created the power which enabled him to do so. He analysed the Milky Way, with its myriads of starry beauties. He found that nebulosities are resolvable into innumerable multitudes of stars; but it was immense telescopes, which his own genius had devised and his hands constructed, that opened these hitherto unknown wonders to his sight.

"The arts," says Baron Fourier, "introduced him to the sanctuary of the sciences. He improved optics; he undertook to describe the natural history of the heavens; he saw new stars at the extremities of the planetary world, the extent of which he doubled. He contemplated innumerable phenomena in regions where the eye of man had never before penetrated. He studied the nature of the sun, divided its rays, measured their brightness, separated light from heat. He saw the effects of gravitation in all the depths of space. To no man was it given to make known to others, so great a number of new stars. Whatever the universe displays of what is immense and imperishable, was the habitual object of his contemplations."

Herschel and Laplace, two of the most illustrious names in history, often arrived at the same inferences by following paths directly the reverse of each other; the demonstration that the ring of Saturn is a necessary consequence of the general principle of gravitation, may be named as an instance.

In contemplating the vast labours of Herschel, and the halo of glory which universally encircles his name, let the self-teaching student, whom difficulties surround and circumstances confine, remember, that Herschel in early life had to struggle against fortune: "but," says Fourier, "he subdued her, and his glory is increased by all that chance of birth refused him." Taken in this point of view, the career of Sir William Herschel is as valuable and cheering to the humble student, as it is magnificent in the history of science.

It is quite true that very few can meet with a benevolent prince to patronize them, and royal generosity to assist them. Fortunate it was, for English fame that Herschel and George the Third happened to be thrown in each other's way on the stage of life. Providence never brought two men together more deserving of each other. Nevertheless, Herschel's career is a heart-stirring subject for the struggling student to contemplate: he might not find a prince to favour him, nor may he possess Herschel's universal genius to deserve it. Still, there are stars of great beauty besides those of the first magnitude; and he can learn from Herschel what an indomitable perseverance can effect, if it be aided by genius and guided by integrity and virtue.

But George the Third's lasting and generous friendship to Sir William Herschel effected more happy results for the nation than we have yet mentioned. Sir William was placed by his royal friend in the sanctuary of science, and in this hallowed home his son, from his cradle, imbibed science;—that son, of kindred genius, grew up under parental care and guidance. In due time he was sent to St. John's College, Cambridge, and at the end of his undergraduateship he became senior wrangler. This splendid vanquishing of a whole host of ardent candidates for academic honours, was the commencement of the achievements of this most celebrated Johnian, and he has

since followed it up with such brilliant success, as to gain for him the admiration of every lover of learning in the civilised world.

Very probably such a father and such a son would have done almost what they wished single-handed; nevertheless it may fairly be assumed that Sir William Herschel, in consequence of his royal friend's kindness, was enabled to bestow a more careful attention on his son's preparatory tuition than he otherwise might have done. What has been the consequence? Why, that son, with an ardour for science, and with a deep affection for his father's fame, which are unparalleled, has added new glories to the celebrities of Herschel. He appears to have been impressed, from the commencement of his course, with the knowledge that the nation and its sovereign had affectionately adopted his father, and regarded him as public property. Sir John, as it were in grateful remembrance of this kindness, has most amply repaid it. He found the nation far below our continental neighbours in mathematical science, and in other matters which depend on that science. He has been foremost in removing this national stigma, and in placing Great Britain in the lofty position with regard to science which she now occupies. These are facts which, we think, admit of direct proof.

During many years, at the beginning of the present century, the great works of Laplace, Lagrange, &c., were unknown to the greater number of English mathematicians. These works were written in symbolical language, which was entirely mystical to most of our eminent cognoscenti. Whether it was a national reverence for our Newton, the inventor of the fluxional notation, or whether it was a prejudice which discords had engendered, that prevented the introduction of works using the differential notation, are questions not easily solved; certain it is, however, that they were *not* introduced. It may be seen that Ivory, Lowry, Wallace, &c.—the most eminent of our mathematicians at that time—invariably used the fluxional notation in the first volume of the "Mathematical Repository," probably about 1804 or 1805. Ivory and Wallace adopted the differential notation about the same time, on Question 172, Vol. II., perhaps about 1812; and they subsequently used it. Mr. Lowry did not employ it until Question 370, Vol. IV., about 1820; he afterwards used the fluxional.

Mr. Mason, an accomplished mathematician of St. John's College, Cambridge, appears to have first introduced the differential notation into the *Ladies Diary* in 1825.

Mr. Thomas Slee, of Terril, near Penrith, used it for the first time in the *Gentlemans Diary* for 1821. He refers to Woodhouse's "Physical Astronomy," which was published in 1818, and in which the differential notation was used.

How full of lively interest are books made up of a series of numbers of scientific literature, such as the *Diaries*, the *Repository*, the *Gentleman's Companion*, the *Philosophical Transactions*, &c. In the former we trace the progress of Emerson, Simpson, Hutton, Gregory, Ivory, Lowry, Wallace, and many others,—men whose memories are consecrated to scientific fame. We see their first appearance as candidates for distinction; mark their upward course; admire them at their culminating point; or ponder at their meridian brilliancy for a few years; and then—they are gone, and other kindred spirits appear to take their place. But, however profitable or interesting such contemplations may be, they are rather tinged with melancholy; the mind naturally reverts to past time, then comes to the present, and forcibly brings home the truth of *Museus's* beautiful thought, which Homer has thus expressed:—

Οἴη πε̃ φύλλων γενεὴ, τοιήδε καὶ ανδρω̃ν.
Φύλλα τα μέν τιἀνεμος χαμαδις χέει ἄλλα δέ θ'ὕλη
Τηλεθόωσα φύει, ἔαρος δ'επιγίγνεται ὥρη
Ὥς ανδρω̃ν γενεή, ἡ μὲν φύει, ή δ' απολήγει.
Ομ: Ιλ. Ζ. 146.

"Like leaves on trees the race of men are found,
Now green in youth, now with'ring on the ground,
Another race, the following spring supplies,
They fall successive, and successive rise;

So generations in their course decay,
So flourish these, when those have passed away."

We hope to be forgiven for making this digression: but to return:—Besides using the differential notation, Laplace and others have invented different modes of calculus to carry out their theories; their methods of applying the calculus of finite differences, generating functions, functional equations, &c., appear to have been nearly unknown in England forty years ago. These celebrated authors were encouraged by every inducement, which a powerful nation and an ambitious emperor, who duly appreciated their importance, could hold out to them. They had, consequently, carried the abstract sciences far beyond the point at which they then stood in England. English mathematicians had not taught themselves the use of the Continental system of calculus—the tools by which such varied and profound works have been completed; indeed, they could be effected by no other.

Sir John Herschel found English science in this predicament; and he seems to have resolved to get her out of it. The first step was a translation of Lacroix's "Differential and Integral Calculus;" in this he was aided by a justly-esteemed veteran in science, the present Dean of Ely. To this work an appendix was added by Sir John Herschel, on finite differences, which gave the English student a clue to some of the subtle artifices of Laplace. This first attempt to advance mathematics in this country was followed by another—a collection of examples in the differential and integral calculus and finite differences; the joint result of the labours of Herschel, Peacock, and Babbage. The last of these celebrated analysts added examples illustrating functional equations. These volumes of examples, have done more towards generating a classical taste in abstract mathematics than any work that can be named. But Herschel did not stop here; he not only allured the British student to the knowledge of those beautiful though abstract theories—but he led the way. To show the advantages of the notation and calculus which the above volumes had introduced, he sent a number of questions on a variety of subjects of a high class, and full of interest to the Mathematical Repository, and his neat and unique solutions brought out the practical superiority of the new modes in a striking light. Who has not heard of the question, "To find the form of equilibrium of an arch built from one planet to another, conceiving each particle animated with a force directed towards the Sun and varying inversely as the square of the distance from its centre"?

A new light was thus let in upon the mathematical world, as far as England was concerned; the new light kindled a new spirit, and called energies into action in the English mind which have since made ample amends for the mental dormancy which had so long prevailed. But besides awakening animation, and opening new fields of inquiry to the abstract mathematician, the publications of the day teem with memoirs and essays containing the application of the new analysis to every kind of physical questions. Without attempting to settle the disputed point as to whether the undulatory or the carpuscular theory of light be the true one, it may safely be asserted that Herschel's treatise on light in the *Encyclopædia Metropolitana* is the first work of the kind that we had, and still remains the best: it has been invaluable, inasmuch as it has been principally the means of making England what it is, with respect to mathematics applied to light. His Treatise on Sound in the same work, is also the very best that we have in our language, and it would not be easy to find one more excellent in any other. The same remarks apply to his Physical Astronomy. These works, more than any other, have been instrumental in renovating English science, and bringing it to the distinguished position which it now holds. Some of them are on subjects to which the English student had been a stranger. But more than this. Although the most refined analysis was applied to the elucidation of these matters, the whole was placed in the clearest light for the reader to comprehend.

These works were obviously written for the purpose of spreading information;—every part evinces the work of a master mind, aiming, not to astonish and to deter, but to bring down intricate topics to the level of common understandings.

The *Preliminary Discourse on Natural Philosophy* deserves the same character. It is the production of a mind which nothing can elude—that opens its rich stores, and invitingly welcomes every one that can read, to the magnificent treat. In addition to these works, memoirs on almost every topic were supplied from the same source to the *Philosophical Transactions*, to the *Edinburgh Transactions*, to the Astronomical Society, to the Geological Society, &c. In all of these, new subjects, or novel modes of investigating old ones, were given. Laplace's celebrated formulæ were brought into use, and more general ones propounded. The torpor which had reigned so long over British analytical science was dispelled—the national mind was roused from its lethargy; fresh fire was infused into it, which has since forced it up to an equality, in point of efficiency, to any competitor that can be mentioned. Due honour be to Peacock, to Babbage, and to a few other kindred spirits; but to Herschel, far above all others, is England indebted for the proud eminence that she now sustains in the abstract and applied sciences.

If there was one source of happiness which could give Sir William Herschel a more exquisite thrill of delight than another, it must have been the public honours so deservedly won by his son.

On November 22nd, 1821, Sir Humphry Davy, then President of the Royal Society, in delivering the Society's Copley medal to Sir John Herschel (then Mr. Herschel) for his mathematical and optical papers, thus spoke of these articles:—"Mr. Herschel," said Sir Humphry, "had not only distinguished himself by profound mathematical investigations, but had likewise made applications of the science of quantity to physical researches, of considerable extent and importance, proving himself, as an analyst, worthy to be associated with a Brinkley, an Ivory, a Woodhouse, and a Young, who, in late times, have redeemed the character of British mathematics—entering those noble paths of investigation opened by the genius of Newton, and too long travelled in almost exclusively by illustrious foreigners. In physical inquiry he had, by his optical papers, added to the obligations already owing to the name of Herschel, in every thing connected with modern astronomy and the knowledge of the celestial spaces. In delivering the medal to Mr. Herschel, the President begged him to receive it as a mark of respect of the Royal Society, and to preserve it as a pledge of future labours in their cause and that of science. He exhorted Mr. Herschel to employ his various talents, with the same industry and zeal in the progress, as he had shown in the commencement of his career, and to recollect that no pursuits were more useful, more dignified, and more honourable at all periods of life. Of this he had a striking example in his illustrious father, who, full of years and of glory, must view his exertions with infinite delight, and, looking forward to the time when his own imperishable name would be recorded in the same annals of philosophy with that of his son, must enjoy, as it were by anticipation, a double immortality." —(Tulloch, *Phil. Mag.*, Vol. lviii., pp. 448). Sir John Herschel at this time was a very young man; but most scrupulously, most nobly, has he ever since followed the advice. The transporting himself and his family to Southern Africa, for the purpose of completing labours which his venerated father had marked out, but which an unusually busy life had not given him time sufficient to accomplish, was a task of filial love which we believe is unparalleled in the history of mankind. The volume which contains the results of that laborious and singular undertaking, is an imperishable record of filial affection and scientific attainment;—the work ennobles the country which the author claims for his home.

(To be concluded in our next.)

PLUMMER'S PATENT IMPROVEMENTS IN FLAX MACHINERY.

(Concluded from page 341.)

V.—MR. PLUMMER finally describes three improved holders for scutching and heckling flax (in addition to those incidentally introduced in the different machines before described). These holders are respectively distinguished as No. 1, No. 2, and No. 3.

Figures 1^e, 2^e, 3^e, 4^e and 5^e, exhibit the details of the holder, No. 1. Fig. 1 being a top plan of it; fig. 2, a side elevation, with one of the doors thrown open; fig. 3, a cross section, on the line *m*, *n*; fig. 4, an end view of the table with the holder open; and fig. 5, a plan of the table with the holder in its place. *a a*, is the bottom piece of the holder, which is formed of wood strengthened by metallic plates, *p p*, screwed on to it as shown; *b b*, are the two doors, which are also of wood, backed with metallic plates, *f f*, and connected to the bottom piece by hinges, *c c*; *d* is a vertical plate, or bar (for which studs or pins may be substituted), by which the holder is divided at the centre into two parts, and against which the two doors abut when closed; *e* is a turning bar which fits on to a stud raised on to the top of the division plate, or bar *d*, and is so shaped at the ends as to fit an ordinary screw key, which may be applied to it for the purpose of turning it round, and so pressing down the doors, *b b*, on the streaks, when laid upon the bottom piece. *f f*, are the metallic plates, which are screwed to the backs of the doors, and receive the pressure of the turning bar, the upper surfaces of these plates and the under surfaces of the bars, being inclined in opposite directions, where they come in contact, besides which these surfaces are cut or roughened in the manner of a file, in order to increase their hold on one another. *g g*, are projections on the edges of the doors, *b b*, which take into corresponding notches in the centre division plate, or bar *d*; and *h h* are grooves and beds formed on the upper surface of the bottom piece, *a*, and under surfaces of the doors, *b b*, for the purpose of enabling them to take a firmer hold of the flax or other material when laid upon the bottom piece. In figs. 4 and 5, A, represents the table of the heckling machine; B, the beds into which the holders are laid, and C, a stout pin or stud, which may be placed between the beds and used in lieu of the dividing-plate *d*, to separate the streaks while in the process of being fastened in the holders.

The advantages of this holder over those of the ordinary forms are, that the inner edges of the streaks are prevented (by the dividing-plate or studs) from getting entangled together; that as large a holding surface, as may be, is obtained without interruption from pins or pegs; that a more uniform pressure is produced on the streaks, and that the durability of the holder is greatly increased by the application of the metallic plates and hinges.

The holder, No. 2, of which figs. 6^e, 7^e, 8^e, are representations; fig. 6^e being a top plan, fig. 7^e a side elevation, and fig. 8^e a cross section, is distinguished from No. 1, in the top piece or door, *b*, being in one piece and turning on one hinge only, *c*, and in the means used to effect the locking of two parts of the holder. A square bolt, *d*, which is fixed in the bottom piece, *a*, passes upwards through a hole, *e*, in the top piece, *b* (when it is down), and has a bevelled slot, *f*, at its upper end, into which there is inserted by hand a key or bolt, *g*, of a wedge shaped form to correspond with the bevel of the slot, which is attached by a chain to the outside of the upper piece, *b*.

In the holder, No. 3, the two parts of which it is composed are hinged at the centre, and diverge from or approximate towards, one another, after the manner of a pair of nutcrackers. The details of this instrument are represented in fig. 1^f, 2^f, 3^f and 4^f. Figure 1^f is an end elevation, fig. 2^f, is a cross section of the same; fig. 3^f is a side elevation, and fig. 4^f is an under view of the holder looking upwards. A frame for carrying the holder through a heckling machine is shown in figs. 5^f, and 6^f. Fig. 5^f being an inside view of one end thereof, and fig. 6^f a longitudinal section of the same. AB are two jaws or clamps made of wood, to both sides or ends of which ribs of felt or some other like yielding material, *e*, *e*, *e*, *e*, *e*, are attached. The thickness of each jaw at its lower extremity, including the felt or other yielding material at each side, is made equal to the length of shift required to allow the heckles, when worked up to the bite of the jaws, to heckle the streak in the middle of its length. CD are two plates that are screwed, or otherwise suitably affixed, to each end of the jaws, AB. From the plate, C, four pins, *a*, *b*, *c*, *d*, project, two of which, *a b*, take into corresponding recesses in the plate D, and thereby form a species of hinge on which the jaws turn. By referring to fig. 2^f, it will be seen that the jaw, B, can be turned round from its position on the right-hand side of the jaw, A, into the successive positions indicated by the dotted lines, till it closes back against

Fig. 1e.

No. 1.

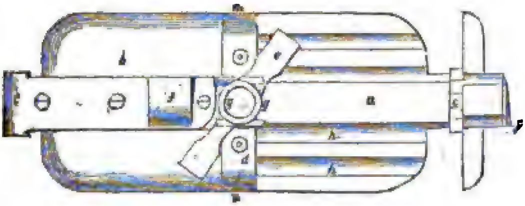


Fig. 4e.

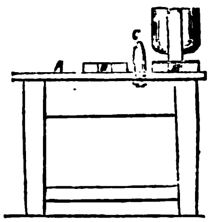


Fig. 5e.

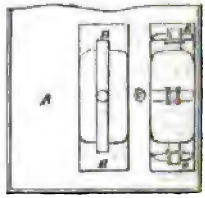


Fig. 2e.

No. 1.

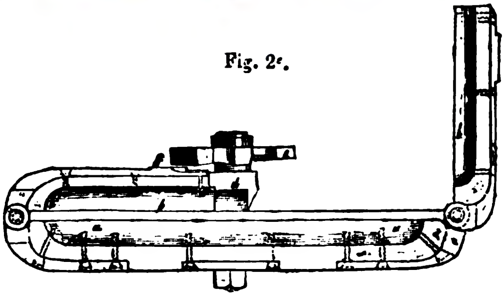


Fig. 8e.

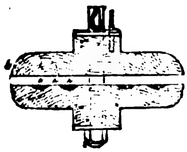


Fig. 6e.

No. 2.

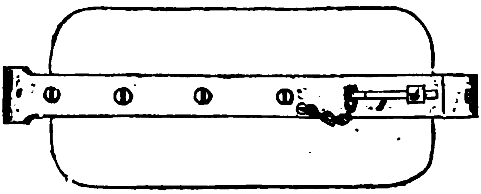
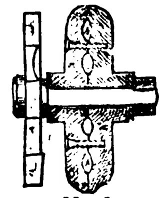


Fig. 3e.



No. 1.

Fig. 7e.

No. 2.

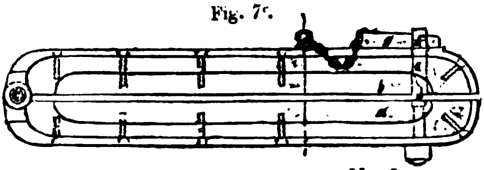


Fig. 1f.

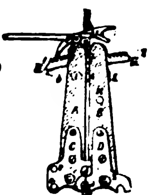
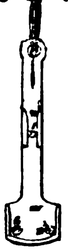


Fig. 5f.



No. 3.

Fig. 2f.

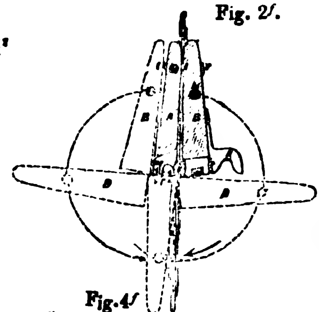


Fig. 4f

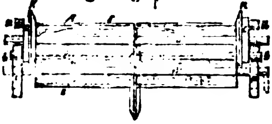


Fig. 3f.

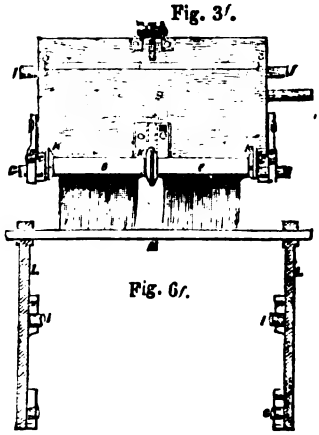


Fig. 6f.

the opposite or left-hand side of the jaw, A. E is an arched metal rack which is affixed to the jaw, B, and has on its upper edge, two sets of teeth cut the reverse way to each other. The curves of this rack are obtained by combining the segments of two circles struck respectively from the centres of the recesses in the plate, D, which receive the pins *a* and *b*, the arc 1 being described from the recess of the pin, *a*, and the arc 2 from that of *b*. F and N are catches which take into the rack, E, and are supported on one pivot or centre at the top of the jaw, A, but are free to work independently of one another. The catch, F, takes into the rack when the holder is in the position represented in fig. 1′, and the catch, N, takes into it when the jaw is in the position shown in the dotted lines, BB (fig. 2′). Thus, on whichever side of A, the jaw, B, is situated, it is there securely held until it is designedly released. G^1 G^2 are square bars of iron which are inserted into recesses in the lower end of the jaws, A and B, and pass through the plates, C and D, where they terminate in round projections, as shown. These bars serve to give strength to the holder, and furnish also convenient supports for it when placed in a frame. H is a cylindrical pin which projects from the upper end of the jaw, B, beyond the support of the holder, for a purpose hereinafter described. I I are cylindrical pins which project from the jaw, A, to the same distance as the ends of the bars, G^1, G^2. K K are guard plates which are attached to the jaw, A, for guiding the flax or other material, while it is being turned over by the movement of the jaw, B, on its hinges. L are the jambs or sides of the holder frame, and M a connecting cross-bar; *m m* are recesses to receive the round projections, G^1G^2, of the holder; and *n n* are guides for receiving the pins, I I, which as they play in the guides allow the jaw, A, which bears the catches, F and N, to oscillate, while its support, G^1, passes across the recess to the position, G^2. Fig. 5′—the respective supports of the jaws, A B, changing places when the holder is folded over. The mode of filling and working this holder is as follows: Supposing the jaw, A, to be laid flat upon a table and retained in suitable recesses or beds made for its reception, the streaks of flax are then laid upon it in the ordinary manner; the jaw, B, is then held vertically or nearly so, and the recesses in its hinge plates are engaged in the corresponding projections of the hinge plates of A. It is then folded upon the flax and pressed flat upon A, when the catch, F, takes into the rack, E, and then holds the jaws tightly together with the flax or other material between them. The holder is then put into the heckling machine, and the streak subjected to the operation of the heckles. When the end of the streak requires to be changed, this is effected by releasing the catch and folding back the jaw, B, to the opposite side of A, taking care to keep the hinge joint in constant contact. This operation can be done by hand without taking the holder out, when such a support as above described is employed; or the movement may be effected by having a crank, with a suitable intermitting motion, to receive and conduct the projection, H, of the jaw, B, in the path traced in the dotted lines, fig. 2, when the descent of the holder in the machine will release the catch, and allow the jaw, B, to be carried round to the opposite side of A; and thus the end of the streak which was originally held between the jaws, A and B, will be left hanging down, while that portion which was originally pendant will be carried up and inclosed between the opposite sides of A and B. With this holder, both sides of the flax or other fibrous material can be successively operated upon for any length of time requisite, without once transferring or shifting the streak from the holder.

These several holders (as well as the holder used with the scutching machine) may be made, in the principal parts, of gutta percha, whereby greater elasticity and durability will be secured. Gutta percha may be also substituted with advantage for felt and cloth where used in flax holders, as, for example, in the holder No. 3, before described.

The improvements in holders which I claim as of my invention are as follows:—

I claim the employment of a division-plate, or bar, or stud, or pin, in the centre of the holder, as exemplified in the holder No. 1, and before described; and the substitution, in all cases where the division plate, or bar, or pin, or stud aforesaid is not used, of a pin or stud fixed in the table of the machine, as also before explained.

I claim also the making of the upper piece of the holder in two parts, each turning on a hinge or hinges independently of the other, and the locking or fastening of these doors by a turning bar acting on both, as exemplified in the holder No. 1, and before described.

I claim also the holder No. 2, in so far as respects the making of the top piece to turn on one end hinge, and the locking of the two pieces by means of a vertical bolt fixed in the bottom piece, and pressing up through the top piece, and having a bevelled or inclined slot at top, into which a key or bolt of a wedge form is inserted.

I claim also the holder No. 3, in so far as respects those arrangements by which either of the jaws or clamps can be folded or doubled back on the other, and the ends of the streak reversed without removing or shifting the streak itself from the holder.

And, finally, I claim the employment, in the construction of instruments for holding flax and other like materials, while being brushed, heckled, scutched, or otherwise treated, of gutta percha, in combination with wood or with iron, or with wood and iron, or with any other suitable material or materials.

REPORT OF THE COMMISSIONER OF PATENTS OF THE UNITED STATES, ON EXPLOSIONS OF STEAM-BOILERS, DECEMBER 30, 1848.

(Concluded from page 326.)

It is objected to this provision that the district judge is not likely, from the character of his pursuits and associations, to be able to form a very correct estimate of the qualifications of applicants for the office. In some cases his residence is remote from the port where the duties of the inspectors are to be performed, which renders it improbable that he could have any personal knowledge of the character of applicants, or be able to exercise over them any supervision. It is, therefore, proposed to place the appointing power in the hands of a resident, or residents, of the port where the inspections are to be made, and with individuals the character of whose pursuits is calculated to render them competent judges of the qualifications of the applicants for the place of inspector.*

Again; this section makes no provision for a separation of the duties of inspecting hulls, and inspecting boilers and machinery; but renders any inspector competent to perform both. The qualifications necessary to perform one of these inspections are quite different from those requisite to perform the other. The inspector of hulls should be a man well acquainted with boat building, whereas the inspector of boilers and machinery should be a sound practical engineer. The union of both these offices in the person of each inspector, renders it almost certain that one of the duties will be ill-performed, and gives rise to a rivalry and competition in the highest degree prejudicial to the character of the inspection; for there is but one voice as to the existence of the fact that steamboat owners and captains will always employ in preference the inspector who is least faithful in the performance of his duty. By dividing the offices, and thus taking away competition, the inspector would be more independent and more likely to make his inspection thorough.* This end would be still farther secured by requiring that all boats in a certain trade should be inspected at a certain port, thus limiting each boat to a single inspector.†

A recommendation which contemplates the examination of inspectors by a board consisting of the best practical engineers, has been made with great unanimity by all who have proposed modifications of the law.‡ It is also proposed that the same board should decide on the qualifications of engineers, who should not be allowed to hold the office without a certificate from the board of examiners: nor should boat-owners or captains be permitted to employ engineers without such certificate.

The elevation of the character and standing of the engineer becomes, in the views of the subject taken in the former part of the report, a matter of primary importance to the safety of the public. It is a fixed principle of human nature that men become worthy of confidence and respect in proportion as they feel themselves to be respected. Services which are deemed worthy of the special notice of the law, which are well paid, and to perform which a man must go through a course of preparatory training, and submit to a rigid and impartial examination, assume, in his eyes, an importance which they cannot have when he receives his appointment without inquiry as to his qualifications, and is left to perform its duties as he may. In the former case, the right performance of duty becomes a point of professional pride; in the latter, it sinks to a mere question of pay. The unanimity with which the recommendation above alluded to has been made, of a board of examiners before whom all candidates for inspectorship, or the office of engineer, should be required to pass before obtaining the office sought, entitles it to respectful consideration. In relation to another department, where the health and life of individuals are placed under the professional care of medical men, the government has acted upon the plan here recommended. The evidence of having received a medical education, and the diploma of the most eminent medical school, are not considered a sufficient guaranty. The candidate for a medical appointment, in either arm of our military service, must pass a searching examination, by an able board of examiners, as to his

* Gray's Com'n, Appendix [G] No. 10.

* Cist's Communication, Appendix [G] No. 1.

† Ibid.

‡ Communications of Elliot, Green, Dawson, &c., Appendix [G.]

knowledge of the theoretical and practical parts of his profession; yet the number of lives dependent upon the skill and care of any one of these officers is not for a moment to be compared with those that hang upon the doubtful competency of an inspector of steam boilers, or a steam-boat engineer. The ignorance of the former may send men to their graves *singulatim* and by retail; but one act of carelessness in the latter may cause the instant destruction of hundreds. If the magnitude of the interest at stake is a sufficient reason for the examination in the one case, it is, *à fortiori*, a reason in the other. Faithfully administered, there can be little doubt that such a system would tend to give new dignity to the employment, by establishing a higher standard of qualification.

The fourth section of the law prescribes the duties of the inspector of hulls, and regulates his fees. The inspection of hulls by a government officer is thought unnecessary, inasmuch as the insurance-offices, which have a deep stake in the security of the vessel, have competent inspectors, appointed by themselves, whose examination, it appears, is much more rigid than that of the government inspectors; and it is said to be no uncommon case for a boat to be condemned by the insurance-office inspector which has just received the certificate of the United States officer.* It is urged, moreover, with some force, that vessels which navigate the ocean, the soundness of whose hulls is a matter of much greater consequence to the safety of the travelling world than that of the hulls of steam-boats, are not burdened with this tax, but left to the exclusive care of the insurance inspectors.† It is proposed, as an additional amendment to this section, that the inspectors should be paid by the government.‡

By the fifth section of the law, the inspectors are required to make a certificate as to the soundness of the boilers, and to furnish the master or owner of the boat with a duplicate of the same. If the inspection, as at present conducted, be, as it is represented, a useless tax upon boat-owners, and of no value as a guaranty of the safe condition of the boilers, the certificate can only serve to beget a false, perhaps a fatal, confidence in the minds of the passengers. Such is the opinion expressed by the Cincinnati Association of Engineers.|| Before the certificate can be of any value, the course to be pursued in the inspection must be plainly laid down, and some exact standard of thickness, strength, &c., be adopted, below which no boilers should be suffered to fall without a denial of the certificate.*

The intervals at which inspections of hulls and boilers are to be respectively performed, are regulated by the sixth section of the law. The fact, well ascertained,† that the strength of boilers may be so impaired by the misusage of a single trip as to be utterly unsafe, would seem to be a sufficient objection to such a limitation. And yet to subject the owners to frequent inspections at a heavy cost, and which may possibly be in most cases unnecessary, appears to be a measure unwarrantably oppressive, and which would operate most severely upon those who were most worthy of public confidence. Some have gone so far as to recommend the monthy application of the hydrostatic test.‡ To secure the benefit of frequent inspections, while their oppressiveness to owners should be avoided, it has been suggested that the inspectors should receive from the boat their fees for the semi-annual examination, and, in addition, a small salary from the government; in consideration of which it shall be their duty to visit and inspect, without unnecessary delay, each boat that arrives at the port.||

The seventh section requires the safety-valve to be opened, when the vessel stops for any purpose whatever, under a penalty of two hundred dollars. Such a provision must have arisen from a misapprehension of the consequences that may arise from the adoption of a fixed rule with regard to the opening of the safety-valve. If the views advanced in the former part of this report, as to the causes of explosions be correct, the opening of the valve at a stopping-place might, under some circumstances, be the cause of the very accident it was intended to prevent. If the water were low, and the top of the flues overheated, the opening of the valve, causing a violent ebullition or "frothing," would throw the water into contact with the over-heated metal, thus suddenly generating a quantity of highly-elastic steam, to which the valve could not afford a sufficiently rapid exit, and an explosion would be the necessary consequence.§ Measures tending to elevate the character of the engineer, and render him more careful and trustworthy, would do away with the necessity

* Cist's Communication, Appendix.
† Haldeman's Communication, Appendix [G]. No. 6.
‡ Cist.
|| Doc. H. R., No. 20, 29th Cong., 1st Session.

* Spencer's Communication, Appendix [G], No. 3.
† Cist's Communication.
‡ Guthrie's Communication, Appendix [G], No. 2.
|| Cist.
§ Doc. H. P. 20, 29th Congress, 1st Session.

for any such interference with the minor regulation of the engine.

The penalties provided in the twelfth section of the law are regarded as too harsh, and it is found that on that account they cannot be enforced. Juries cannot be induced to subject a man to the penalties of manslaughter for an act of negligence to which they find it impossible to attach the degree of guilt which so severe a sentence would seem to imply.*

The thirteenth section makes the fact of the explosion *primâ facie* evidence of negligence, in all suits or actions against proprietors of steam-boats for injuries arising to persons or property from the bursting of the boiler, &c. This provision, it is urged, raises an adverse presumption upon a fact which it is impossible to deny, and throws upon the defendant the necessity of proving a negative, a task always difficult, and rendered peculiarly so by the circumstances of terror and excitement which always attend these events. The severity of this feature of the law is said to have driven many worthy and enterprizing steam-boat proprietors from the business, and left it in hands less responsible.†

The law of 1843 has exclusive reference to the steering apparatus of "vessels propelled by steam," and therefore has no bearing upon the subject of this report.

Such, then, are some of the objections to the existing law which have been advanced by men who have had the best opportunities of witnessing its practical working. Though it can scarcely be denied that they are, in the main, well founded, yet the undersigned is not prepared to recommend the remedies which are suggested. He is convinced, by as thorough an examination of this subject as his time and the means of information in his possession would permit, that, by descending to the details of management in matters of which it cannot be the best judge, the law subjects itself to the charge of oppression, or lays itself open to contempt. If constructors and engineers could be made competent and careful, there would be no necessity for minute directions, and where they are not so, no legislation can protect the public against the consequences of their misconduct. For it is not to be supposed that a man who would neglect his duty, at the risk of his life, could be induced to perform it by any motives the law could bring to bear upon him.

It is the deliberate opinion of the undersigned, that the best remedy for all the evils complained of would be to make a strong appeal to the interests of boat-masters and proprietors, by giving a remedy, where explosions result in injury to persons or property to the individuals wounded, or to the nearest relative or friend of the killed, in the shape of heavy damages recoverable by action at law. And the undersigned would recommend that in addition to the personal responsibility of the owners, the boat itself should be held by way of *lien* to respond the damages which may be recovered by the plaintiff; and that, in case the owner is an incorporated company, the members of the company should be held severally as well as jointly liable in their individual capacities. Such a course would bring the most powerful motive to bear to force the proprietors to employ in the construction of boats, the best materials and the most skilful and faithful workmen, and to entrust their management to those engineers alone who can bring the most satisfactory evidence of their competency, carefulness, and good character. Properly constructed, the steam engine is believed to be as free from defects as most human contrivances, and, under careful and intelligent management, as free from danger as the nature of the powerful agent it is intended to control can allow us reasonably to expect.

In expressing these views the undersigned would not be understood as intending to undervalue or discourage the exercise of ingenuity in the multiplication of the means of security, or those investigations of science which tend to develope the *natural causes* upon which these lamentable occurrences may depend. On the contrary, he is convinced that the government cannot more legitimately exercise an enlightened care over the safety of the people, than by fostering such ingenuity, and promoting such investigations by providing the means for their prosecution.

The peculiar circumstances of western steam navigation seem to make it a subject worthy of special attention. The fact that disasters seem in a great measure to have ceased in all parts of the country except on the Mississippi and its tributaries, renders it probable that there are causes in operation on those waters which do not exist elsewhere, and which deserve investigation. One of these causes may be found in the quantity and peculiar nature of the deposits from the turbid water of those streams. From a report made to the American Association for the advancement of science, in September, 1848, it appears that of the whole mass of water passing down the Mississippi, when examined near Natchez, not less than one

* Cist.
† Guthrie's Com. Appendix [G.] No. 2.

part in every 528 is solid matter, capable of being deposited by simple repose. How much more would have been deposited had the water experimented on been evaporated to dryness, or in other words, how much solid matter was in a state of chemical solution, has not yet been determined. That the quantity thus held in solution is very considerable, is rendered probable from the known fact that the waters of the Ohio at least give incrustations to evaporating vessels, even when no turbidness or mechanically suspended matter exists in it. It is also known to possess the quality of "hardness," as proved when tested by the usual re-agents.

The exact nature of these sediments has not yet been ascertained, but seems eminently worthy of a careful determination. Their bearing upon the question of efficiency of the safety apparatus is frequently alluded to in the Report of the Board of Examiners of 1844, so often referred to; but the investigation, not being contemplated by their appointment, was not gone into. The utility of such an investigation will be apparent from the fact, before alluded to, that in the case of sea-going steamers, it has led to the discovery of the nature of some of these incrustations and the application of a solvent.

The same minute and searching inquiries which have been instituted with regard to the strength of materials for boilers, the causes of explosions, and their remedies, and the numerous incidental questions hitherto examined under public authority, if applied to the peculiar circumstances of western navigation, would undoubtedly tend to develop the causes, and suggest remedies for the evils which still exist in connection with that important branch of our internal trade. Many points of the subject would suggest themselves to the scientific minds to which it should be referred—minds competent to detect by observation, and develop by experiment the difficulties in which it is involved.

I have thus, as far as the means of information in my possession permitted, complied with the requisition of the Senate. In doing so, free use has been made of the latest and best authorities on the subject of boiler explosions, and it is believed that full credit is given wherever such sources have been resorted to. The labours of the Franklin Institute Committee have been considered as the most valuable additions to the amount of our knowledge on the subject, and they have therefore been largely quoted. It is a subject of regret that so little that is new in relation to the causes and the means of prevention of explosions could be submitted for your consideration. The accounts given in the returns go so little into detail, and are marked by so many important omissions, that any satisfactory generalizations from them were rendered almost impossible. But the undersigned is of opinion that, though the present report may throw no new light on the subject, yet the service of presenting, in one condensed general view, a *resumé* of the present state of knowledge in relation to this subject, in a form intelligible to the general reader, may be one of some value in its bearing upon intelligent legislation, and as affording a useful source of information to the practical men, perhaps deficient in scientific knowledge, into whose hands this report may possibly fall.

The main points of this inquiry seem to have been exhausted by the very able Report of the Committee of the Franklin Institute. Their investigations may be considered as having settled most of the questions to which their attention was directed. There still remain, however, some points not fully determined by that Committee, and which have already been alluded to in this report, but which may well be recapitulated here. They are: 1st. As to the extent to which a local relief of pressure would operate to produce a difference of level in the water in a boiler, and whether an explosion could result from such difference. 2nd. A more full investigation of the repulsion between water and metals heated to a certain temperature. 3rd. The whole subject of incrustations is yet comparatively open as a field for investigation.

On these points the undersigned takes the liberty of suggesting the institution of an investigation, to be made at the expense of the government, and conducted, as were the valuable labors of the Franklin Committee, under the auspices of some recognized scientific association. On the subject of deposites, these experiments should extend to the sediments of all the principal rivers navigated by steam in our country. Aside from the relation to the subject now under consideration, the geological results of such an investigation could not fail to be of great interest and value.

I have the honour to be,

Very respectfully,

Your obedient servant,

EDMUND BURKE,

Commissioner of Patents.

To the Hon, GEO. M. DALLAS,

Vice-President of the United States, and President of the Senate.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 18TH OF OCTOBER.

GASPARD BRANDT, Little Gray's-Inn-lane, Middlesex, merchant, *for improvements in the construction of the bearings of railway engines, and railway and other carriages now in use.* Patent dated April 13, 1849.

Mr. Brandt's invention consists in the application of a pair of antifriction wheels, or rollers, to the bearings of carriage axles. The antifriction rollers are mounted upon separate axles, supported in the back and front faces of the axle box, which is made with a slot to receive the carriage axle, and attached by springs to the body of the engine or carriage. The axle box is further secured by means of bands, which, however, allow it to slide freely up or down. The antifriction rollers bear upon the axle and make but partial revolutions to one entire revolution of the latter. The top of the slot is made circular, so that should the rollers give way, it may bear on the axle, and the carriage be thereby supported. In applying this invention to ordinary carriages, wagons, for instance, the antifriction rollers are placed in the nave.

Claim.—The mode of constructing the bearings of railway engines and railway and other carriages.

LOUIS PROSPER NICOLAS DUVAL PIRON, of Paris, engineer. *For certain improvements in tubes, pipes, flags, kerbs for pavement, and tram-roads.* Patent dated April 16, 1849.

M. Piron states that his invention consists in constructing piers and breakwaters by driving a number of hollow iron piles, bound together by clamp irons, and arranged in compartments, which are afterwards to be filled with concrete, as well also as the interstices between them; and that it may be applied to the different other uses mentioned in the title by employing iron moulds and hollow iron cores, the spaces between which are to be filled with concrete rammed down hard. M. Piron proposes, lastly, to construct foundations for lighthouses and other purposes by employing two concentric cylinders composed of sheet iron riveted together, with the space between their two peripheries filled with concrete, which will have the effect of causing them to sink in proportion as the sand is dug out from the inside cylinder.

Claims.—1. The production of tubes, pipes, flags, kerbs for pavement, and tram-rods, by inclosing concrete between two surfaces of iron.

2. The application of concrete, combined with two iron surfaces, to the construction of piers, breakwaters, viaducts, bridges, &c.

[M. Piron is very good; but he has disclosed to us no more than all the world—on this side of the Channel, at least—knew before. If he will refer to the papers by the late Brig.-Gen. Sir Samuel Bentham, which have appeared at different times in our pages, and to the specifications of Mr. Bush, Dr. Potts, and Mr. Beardmore, he will find that he has been fully anticipated in everything he proposes.]

JAMES CHILDS, Earl's-court-road, Old Brompton, Middlesex, wax bleacher. *For improvements in the manufacture of candles, night lights, and candle lamps.* Patent dated April 16, 1849.

These improvements consist—

1. In bleaching palm oil, tallow, and fatty bodies by the application of oxide of chlorine, in the following manner:—One ton of palm oil is heated to a boiling point in wooden vessels by free steam, then allowed to settle, and mixed with 2 lbs. of chlorate of potass, 4 quarts of sulphuric acid, sp. g. 1·8, diluted with an equal quantity of water. It is then boiled for twenty minutes, and 1 pint of sulphuric acid, likewise diluted with water, added to it; after which it is allowed to cool, when it is ready for use.

2. In coating the wicks of tallow candles, which do not require snuffing, with stearic acid.

3. In making the night lights of different materials in horizontal strata—the top one of a long-consuming, and consequently expensive substance, and the bottom one of a quicker consuming and cheaper substance.

4. In constructing the cases or boxes of night lights of wood, instead of paper, as heretofore; or,

5. Constructing the cases of sheet metal, which, from its indestructability, will prove (so it is stated) more economical than either the preceding or any other method.

6. In manufacturing the nozzles of candle lamps of glass or earthenware instead of metal, in order to prevent, as much as possible, the communication of heat from the flame to the tallow.

Claims.—1. Bleaching palm oil, tallow, and other fatty bodies, by means of oxide of chlorine.

2. Coating the wicks of tallow candles which do not require snuffing with stearic acid.

3. Making night lights of different materials in strata.

4. Making the cases or boxes of night lights of wood or

5. Of metal.

6. Manufacturing the nozzles of candle lamps of glass or earthenware.

THOMAS COCKSEY, Little Bolton, Lancaster, millwright; and JAMES NIGHTINGALE, of Brightines, in the same county, bleacher. *For certain machinery to facilitate the washing and cleansing of cotton and other fabrics, which machinery is applicable to certain operations in bleaching, dyeing, printing, and sizing warp and piece goods.* Patent dated April 16, 1849.

This machinery consists of a long trough filled with water, above the surface of which a number of beaters and angular carriers are arranged alternately and supported on axles passing through the sides. Beneath the beaters and carriers, and immersed in the water, are a like number of rollers. The beaters consist each of two leaves, so that at each revolution they strike the fabric twice, and are made to rotate by the intervention of toothed gearing from any prime mover, while the only motion communicated to the carriers and rollers is that which results from the passage of the fabric over their peripheries. The fabric is passed over the carrier, nearest to the outflow end of the trough, under the immersed roller, then over the beater, afterwards under another immersed roller, and so on throughout the series—travelling in a direction the opposite to that of the current, in order that as it becomes cleansed it may encounter cleaner water. When the fabric is slight the beaters are driven at a reduced speed by the application of clutch boxes to their axles. The fabric is drawn between a pair of pressing rollers, and, lastly, wound upon another roller to be ready for use. This machinery may, it is stated, be readily applied in the bleaching, dyeing, printing, and sizing of warps and piece goods.

Claims.— 1. Combining a number of beaters with a trough, so as to cause the fabric to descend into and ascend from the water successively.

2. Combining a series of angular carriers with a succession of beaters, as described.

3. The application of clutch boxes to the axles of the beaters, for the purpose of reducing their speed.

ROBERT CLEGG, JOSEPH HENDERSON, and JAMES CALVERT, Blackburn, Lancaster, manufacturers. *For certain improvements in looms for weaving.* Patent dated April 16, 1849.

These improvements refer, firstly, to arrangements for applying the brakes to the driving pulley of power looms previously to their being thrown out of gear; secondly, to jaw temples; and thirdly, to what is known by the name of "Smith's temple."

1. The patentees propose to dispense with the ordinary spring or loose swell, the frog and finger on the stop rod, and to employ instead a curved or segmental piece attached to the top of the back or upright lever, which projects at right angles from the tail lever. The end of the latter is keyed on an axle, which is their common centre of motion, while the other end is furnished with a notch that takes into a slot in the connecting rod of the brake apparatus. The tail lever is curved, and travels under a bowl upon the loom, so that when the shuttle boxes regularly, the segmental piece which constitutes the swell is previously withdrawn from the box; but when it fails, a spring behind the swell forces it into the box, and, as the slay advances, it thrusts the tail lever forwards, whereby, through the intervention of the connecting rod and a system of jointed levers, the brake will be applied, while the farther advance of the slay will cause the driving band to traverse from the fast to the loose pulley. By this arrangement for partially stopping the loom before it is out of gear, it is stated, that a light description of brake can be employed, and injury from concussion avoided. Or, the driving pulley is made with a conical periphery, and is arrested in its revolution by the application of a rod with an inclined surface.

2. The improvements in jaw-temples consists in placing one on each side of the fabric (for the purpose of keeping it distended) and communicating motion to their respective jaws by means of bevel gearing and a system of levers and springs. The free end of the levers rest upon two heart-shaped cams, which are keyed upon the same driving axle, whereby the jaws are opened or closed, and caused to approach to or retire from each other, as required.

3. Lastly, as regards "Smith's temple," it is proposed to fix a rod upon the top of the fabric, extending across from one temple to the other for the purpose of keeping it down.

Claims.—1. Effecting the application of friction breaks in power looms previously to their being thrown out of gear, and the mechanism for applying them to the driving pulley.

2. The arrangement for causing the tail lever to travel under the bowl, by which the swell will be withdrawn from the box before the shuttle enters it.

3. The construction of the swell and back lever in one instrument.

4. The employment of a conical driving pulley, and inclined surface for the purpose of acting as a break.

5. The arrangement of jaw temples.

6. The use in "Smith's temples" of a rod stretching across the fabric between the roller and the beam.

WILLIAM LITTLE, Strand. *For improvements in the manufacture of materials*

for lubricating machinery. Patent dated April 16, 1849.

These improvements consist in the application of the products brought over by the distillation of petroleum as a lubricating substance in combination with other materials. The petroleum is distilled in a retort, and the greasy products are mixed in the proportion of 45 parts to 32 parts of tallow, 75 parts of soda ley (10° to 11° Beaumé), and 29 parts of water, when in the state of saponification.

Claims.—The manufacture of lubricating matters for machinery by the application of the products of petroleum.

WILLIAM HENRY PHILLIPS, York-terrace, Camberwell New-road, Surrey, engineer. *For improvements in extinguishing fire, in the preparation of materials to be used for that purpose, and improvements to assist in saving life and property.* Patent dated April 16, 1849.

Mr. Phillips' present invention refers; firstly, to the mode of constructing apparatus in which is generated the gas to be applied to extinguish fire, and which was the subject of a former patent; and, secondly, to the preparation of the material by the ignition of which the gas is generated.

1. The material, consisting of equal parts of chlorate of potass and sugard and moulded into a homogeneous mass, is placed in a perforated cylinder within a second perforated cylinder, contained in a third cylinder, which is air-tight, and the whole is inclosed in an outer casing. Water is placed in the space between the bottoms of the third cylinder and outer casing, which is fitted with a vertical pipe which opens into the space between the second and third cylinders, so that as the metal expands from the application of heat, the water will be forced up the pipe and made to mingle with gas, which will afterwards escape through an opening in the top of the case. The "material" is ignited by driving a pin down into the midst of it. The patentee describes several modifications of the preceding apparatus, among which is one wherein steam is applied to exhaust the gas, and turpentine poured in to promote the combustion of the material.

2. Instead of mixing the materials with water and moulding them into form, he proposes to boil them in water, and evaporate a portion of it, so that the mass may be in a plastic state and easily moulded into the desired form.

Claims.—1. The improvement in apparatus for extinguishing fire.

2. The mode of preparing the materials employed for that purpose.

HENRY BESSEMER, of Baxter House, Old St. Pancras-road, engineer. *For improvements in the modes of extracting saccharine juices from the sugar-cane, and in the manufacture of sugar, as also in the machinery or apparatus employed therein.* Patent dated April 17, 1849.

I. Mr. Bessemer describes and claims, firstly, a cane press, of which the following are the principal characteristics:—

1. The machinery for expressing the saccharine juice is combined in one framework, with the steam machinery for working the same.

2. The canes are passed through perforated tubes laid longitudinally, *and left open at the discharge end*—the necessary resistance to the expressing piston being obtained by the friction of the canes against the interior sides of the tubes.

3. The canes are cut into lengths adapted to the size of the containing tubes, by means of the same pistons, by which they are immediately afterwards pressed. And

4. The reciprocating movements of a steam driving piston, are combined in a novel and exceedingly ingenious manner with those of two expressing pistons, whereby the latter are made to exert throughout each stroke a gradually increased pressure with a gradually diminishing velocity.

II. An improved apparatus is also described and claimed for heating and regulating the temperature of the cane juice in its progress from the cane press to the defecating vessel.

We shall give in an early Number the full details of these improvements, with engravings.

THOMAS NICHOLAS GREENING, of the firm of Messrs. Burdekins and Greening, of Sheffield, cutlery manufacturers. *For improvements in knives and forks.* Patent dated April 17, 1849.

As table knives and forks are now ordinarily manufactured, the blade or fork is secured to the handle by inserting the tang into a hole bored for it in the centre of the handle (the tang being generally much shorter than the handle), and filling in with resin. And when it is intended that the handle should balance the blade or prong, the hole is enlarged for the purpose of introducing a quantity of lead sufficient to complete the required counterpoise. When knives and forks, however, are thus made up, they are very apt to become loose in their handles from the shrinking or melting of the resin, under the strong heats to which such articles are commonly exposed, especially in cleaning; while the handles themselves are apt to crack and split, in consequence of the thinness to which they are reduced by the extent to which the hollowing is carried out in order to make room for the lead required to produce a perfect balance.

Now, Mr. Greening's improvements con-

sist in so connecting knives and forks to their handles that it shall be impossible for them to become detached, through mere tear and wear, under any circumstances; and so also that the introduction of lead into the handles as a balance shall be rendered unnecessary. He effects these improvements chiefly by making the tang of almost the entire length of the handle, and carrying the hole in which it is inserted quite through the handle, so as to admit of the tang being secured at its extreme end by means of a nut and screw. The blade or prong can therefore be only separated from the handle by purposely undoing the screw, while the tang, from its increased length, suffices (or may be readily made to suffice), together with the increased weight of the handle itself, to balance the blade or prong.

Claims.—1. The making of knives with tangs, as above described.

2. The making the handles to balance the blades or prongs without the use of lead,

3. An improved mode of putting on the ferrule where ferrules are used.

ALEXANDER ALLIOTT, of Lenton Works, Nottingham, bleacher. *For improvements in apparatus for ascertaining and for marking or registering the force or pressure of wind, of water, and of steam, the weight of goods or substances, and the velocity of carriages; also an apparatus for ascertaining, under certain circumstances, the length of time elapsed after carriages have passed any given place, and for enabling the place or direction of floating bodies to be ascertained.* Patent dated April 17, 1849.

Claims.—1. The employment of an independent column of air to transmit or communicate the force of wind (natural and artificial) to a registering apparatus.

2. A flexible diaphragm (which acts on the column of air) of vulcanized India-rubber, of a peculiar form, which is figured and described.

3. A registering apparatus on a new plan.

4. An air-pressure registering apparatus.

5. The adaptation of the apparatus (1) to ascertaining and registering the force or pressure of water.

6. The adaptation of the apparatus (3) to steam.

7. Another.

8. An improved weighing machine, of which the chief peculiarity is, the employment of wheel-work carrying numbering plates and index hands, that are moved in proportion to the elongation of a spring, but which is at the same time so disconnected, that the power required to move the wheel-work shall produce no effect on the spring.

9. An improved method of moving, by machinery, the weight on the steelyard of steelyard weighing machines.

10. Another method of effecting the preceding object.

11. A third method of ditto.

12. The employment, in weighing machines, of a system of numbering wheels for printing and registering the weights as ascertained.

13. The employment of fluids, in a peculiar manner, to ascertain and regulate the velocity of carriages.

14. An apparatus for ascertaining the length of time which has elapsed after a train of carriages has passed any given point.

15. The construction, for the purpose of ascertaining the place or direction of floating bodies, of the mariners' compass, with chemically-prepared paper moved by suitable clock-work.

JOHN RUTHVEN, engineer, Edinburgh, Scotland. *For improvements in preserving lives and property from water and fire, and in producing pressure for various useful purposes.* Patent dated April 16, 1849.

1. Mr. Ruthven proposes to build a water tank, either on the roof of the house or on an eminence at any convenient distance from it, and to have a pipe, similar to a gas pipe, running down the front of the house, with an outlet pipe opposite a window in each story. The ends of these pipes are threaded, in order that a flexible pipe of gutta percha or India-rubber, or other waterproof material, fitted with a director at the other end, may be screwed on as required.

2. The patentee next describes a portable fire extinguisher, which is constructed of a vessel, to which water is supplied from any convenient source, above which is a cylinder containing a piston worked up and down by a rack and pinion. A valve, opening upwards, is fixed in the pipe between the vessel and cylinder. At the side of the cylinder is an air vessel, with a one-way valved pipe communicating with the cylinder, and fitted with a flexible pipe, whereby the water is conducted in any required direction as it is forced out.

3. A life-preserver follows, which consists of an air-tight bag constructed to fit into a hat, travelling-bag, &c., which is provided with a short flexible pipe and valve opening inwards when air is blown, and closing of itself when that pressure is removed, in order to allow of free respiration.

4. An improved press is next described, which consists of a bed-plate with two pillars (one of which is slotted) fixed to the two opposite ends. A beam lever is bolted in the fork of the solid pillar, and carries in the centre a connecting rod which is attached to the top plate. The other end of the lever is bolted to a connecting rod, which is attached to the bottom of a curved lever,

provided with a handle, so that the depression of the latter forces the beam lever downwards, and consequently the top plate upon the bed plate.

Claims.—1. As regards the arrangement of apparatus for preserving life from fire, the screw couplings, stop cocks, and flexible pipes of some impermeable material.

2. In respect to the portable fire extinguisher, not the form, but the arrangements for producing the effect.

3. Inflating with air water-tight bags, adapted to hats, bags, &c., and the employment of the one-way valve.

4. As regards the means of producing pressure, not the form, but the arrangements for producing the effect.

Charles Shepherd, Leadenhall-street, London, chronometer-maker. *For certain improvements in working clocks and other time-keepers, telegraphs, and machinery by electricity.* Patent dated April 16, 1849.

Claims.—1. The employment in chronometers, of apparatus actuated by electro-magnetism for winding up the remontoir escapement, which is retained by a detent.

2. Giving audible signals in chronometers, by means of a locking plate, and apparatus connected therewith, worked by electro-magnetism.

3. An arrangement of apparatus for making and breaking the circuit.

4. A peculiar arrangement and adaptation of apparatus, worked by electro-magnetism, to chronometers.

5. The combination in chronometers and telegraphs, of two pallets and detents for giving the step-by-step motion.

William Hyde Knapp, Long-lane, Southwark, chemist. *For improvements in preparing wood for the purposes of matches and fire-wood.* Patent dated April 17, 1849.

Claim.—A mode of preparing wood for matches and fire-wood by immersing it in rosin oil.

William Edward Newton, Chancery-lane, C.E. *For improvements in machinery for the manufacture of net, lace, or other similar fabrics.* (Being a communication.) Patent dated April 16, 1849.

The object of the present invention is to remedy, by the following arrangements, the inconvenience arising (1) from the delivery of unequal quantities of warp threads, when some of them are taken up to form the work, and the consequent different degrees of tension at which the others are kept, (2) from the decreasing tension of the warp threads due to the diminishing diameter of the warp beam as the work proceeds; and (3) from the varying tension of the weft threads due to the same cause.

1. Instead of winding the warp threads all upon the same beam as hitherto, it is now proposed to wind each one upon a separate plate which is rounded at top, so as not to interfere with the delivery of the thread, and placed in one of the cells of a "honey-comb" box.

2. The thread is led through one of the perforations of a metal plate, and wound three or four times round a bobbin, which is thereby suspended, whence it passes through another perforated metal plate, and then to the machine. The bobbin is suspended on a carriage, to maintain it at suitable distances from the top and bottom plates.

3. The inventor places similar regulating bobbins between the weft bobbins and the machine, whereby the weft threads are maintained at a uniform degree of tension. Lastly, the fabric is drawn between a pair of presser rollers, that deliver it to the cloth beam, which is driven from the axle of one of the rollers, in order that the strain may be uniform throughout.

Claims.—1. Dispensing with the use of the ordinary warp roller, and in place thereof arranging the warp threads separately and independently of each other, so that varying quantities of warp thread may be given off as required, without interfering with the tension of the contiguous threads.

2. The use of regulating bobbins to maintain the warp threads at a uniform degree of tension.

3. The arrangement of regulating bobbins for supplying the weft threads at a uniform degree of tension.

William Edward Newton, Chancery-lane, civil engineer. *For improvements in boilers and steam generators.* (Being a communication.) Patent dated April 17, 1849.

This invention applies to steam boilers in which the tubes are used as water passages instead of smoke flues, &c., and consists in curving one of the ends, and causing it to pass through the crown to nearly the top of the water, to allow for the expansion of the metal. The other ends are supported in a vertical plate behind the chimney, and open into the boiler. The turned up ends are fixed over the furnace, in order that the water may travel in a direction opposite the current of the products of combustion.

Claim.—Making the water tubes or pipes of steam boilers or generators with one of the ends curved or turned upwards, and with both ends communicating with the water in the boiler.

George Remington, Warkworth, Northumberland, civil engineer. *For certain improvements in locomotive, marine, and stationary steam engines, and in hydraulic and pneumatic engines.* Patent dated April 17, 1849.

The principal features of Mr. Remington's

numerous improvements and modifications (illustrated by fifty-one drawings) are—

1. A mode of converting rectilineal into rotary motion, by causing a stud fixed on the piston to take into an endless groove cut on the inside periphery of a hollow tube, at acute or oblique angles to its central axis. The tube passes through stuffing-boxes in the cylinder covers and piston. The arrangement for converting rotary into rectilineal motion is the converse of the preceding one.

2. A steam valve, consisting of a cylinder closed at one end, and divided into two compartments by a central partition, the other end of which is ground smooth to fit concentrically on the steam chest, which is divided into four equal compartments, so that as the valve revolves the steam will flow up the first compartment and down the second into one end of the cylinder, while the steam on the other side of the piston will flow up the third compartment and escape to the exhaust down the fourth. The continued revolution of the valve will cause steam to enter the previously-exhausted end of the cylinder. This valve gearing is constructed on the same principle as first described.

3. An arrangement for dispensing with the use of the hollow pipe by means of a rod attached to the piston and crank-pin, which vibrates in an opening in the top of the cylinder. This opening is closed by a flat valve, which carries a gland through which the rod passes.

4. A mode of constructing double-cylinder engines by employing two concentric cylinders. The space between the outside and inside peripheries being fitted with an annular piston having two rods connected to cranks set at right angles to the central one.

5. Various modes of centreing oscillating cylinders on solid trunnions, and admitting and exhausting the steam through jointed pipes.

Mr. Remington's claims are so numerous and voluminous, and refer so repeatedly to arrangements shown in the drawings, that we must decline repeating them, except the first of the final eight, which is, by-the-by, sufficiently comprehensive:—

"All the arrangements of locomotive, marine and stationary steam engines, and hydraulic and pneumatic engines, as described in the specification and represented in the accompanying drawings."

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Debell Tuckett, of Plymouth, Devon, merchant, for a new and improved method of preparing a manure called superphosphate of lime, without using any acids in the decomposition of the various substances of which the manures now in use, and for which patents have been obtained, called superphosphate of lime, by the application of artificial agency, by which more than double the quantity of a true superphosphate of lime can be produced beyond that for which any patent has hitherto been granted, that the same may be applied in the production of all kinds of crops, more particularly wheat, barley, oats, turnips, and other vegetables. October 18; two months.

Thomas Dawson, of Melton-street, Euston-square, machinist, for improvements in cutting and shaping garments and other articles of dress for the human body. October 18; six months.

George Shove, of Deptford, Kent, for improvements in manufacturing ornamented surfaces when glass and other substances are used. (Being a communication.) October 18; six months.

Joseph Stovel, of Suffolk-place, Pall-mall East, Middlesex, tailor, for improvements in coats, part of which improvements are applicable to sleeves of other garments. October 18; six months.

David Hulett, of Holborn, Middlesex, gas engineer; and John Birch Paddon, of Lambeth, gas engineer, for improvements in gas meters and in gas regulators. October 18; six months.

Ethan Campbell, of New York, philosophical, practical, and experimental engineer, and artizan of the United States, for certain new and useful improvements in the means of generating and applying motive power and in propelling vessels. October 18; six months.

William Wyatt, of Waterloo-cottage, Oldswinford, Worcester, pump-maker, for improvements in coating the surfaces of pumps, pipes, cisterns, and other articles of iron. October 18; six months.

Charles Felton Kirkman, of Argylo-street, Middlesex, gentleman, for certain improvements in machinery for spinning or twisting cotton, wool, or other fibrous substances. October 18; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Oct. 13	2054	William Tranter	Birmingham	Lever catch for pistol locks.
„	2055	A. Beldham and Co.	Portsea	The Roman toga.
15	2056	Oliver and Co.	Regent-street	Graduated plug-flower-pot.
„	2057	Edward Burgess and Thomas Hewetson	Clerkenwell-green — Robert-st., Bedford-row	Thermomotive spring.
16	2058	Brown, Lennox and Co.	Billiter-square and Millwall	Instrument for retaining the links of a flat chain in position.
17	2059	Charles Minific	Bristol	Shirt.
„	2060	Charles C. B. Williams and Co.	Old Montague-street, Whitechapel	The Family Safeguard Match box.

CONTENTS OF THIS NUMBER.

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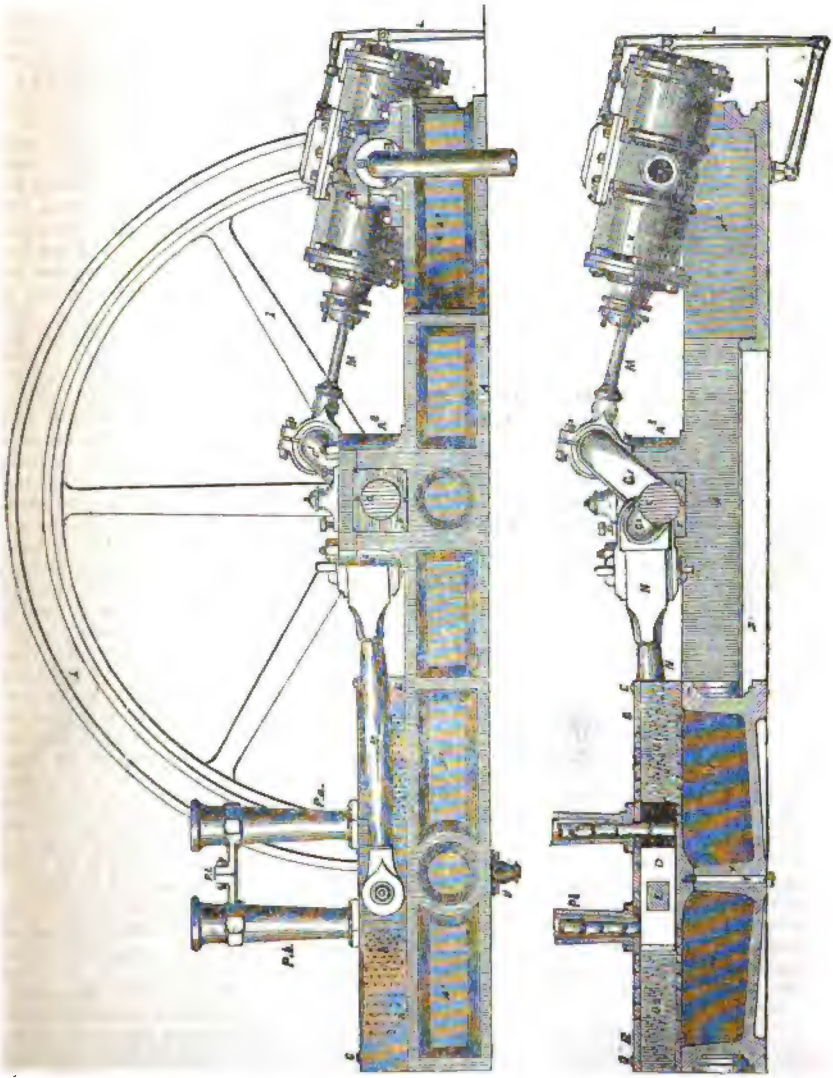
Edited by J. C. Robertson, 166, Fleet-street.

BESSEMER'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF SUGAR.

Fig. 1. Fig. 2.



BESSEMER'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF SUGAR.

(Patent dated April 17, 1849. Patentee, Henry Bessemer, of Baxter House, St. Pancras, Engineer. Specification enrolled October 17, 1849.)

We stated in our last the leading features of this valuable invention, and now proceed, as promised, to supply from the patentee's specification the following descriptive details.

Mr. Bessemer introduces the first branch of his improvements — those, namely, relating to the expression of the saccharine juice from the cane—by the following explanatory remarks:—

The cane mills now generally employed for extracting the saccharine juices from the sugar-cane consist of an arrangement of rollers, the number and position of which are varied; but most commonly three rollers are used, and arranged so that the canes are pressed a second time in passing through the spaces between them, which spaces are increased or diminished by regulating wedges or screws, motion being communicated to the rollers by suitable gearing in connection with any first mover; the canes are fed endwise in between them by hand, several passing through at one time, crossing each other occasionally in all directions. The expressed juice runs into a receptacle below, and the refuse cane or megass passes out on the opposite side of the machine. Cane mills of this description are subject to various defects, which I will here briefly point out, in order to show more clearly the nature of the present invention, which has for its object to lessen or entirely remove these defects. In order to extract the juice from a cane by means of a rolling-mill, it is obvious that the rollers must be set sufficiently close to give a very tight pinch; but the rollers must not be too close, otherwise the cane trash is so lacerated and broken as greatly to lessen the value of the waste or megass for fuel, besides which, the too hard pressing of the cane extracts certain other matters therein contained, which are found to be highly prejudicial to the saccharine juice. It is therefore clear that, to produce the best effect, the rollers should be set at a certain ascertained distance apart, which distance ought, of course, to depend on the thickness of the cane. For, suppose two rollers are placed so as to produce the best effect on a cane of 1½ inch in diameter, and that in the course of work two canes pass through together, one of which is an inch thick and the other two inches, it must follow that both will be done imperfectly, since their respective bulks are as four to one, the small one being only partially pressed, and a small portion of the saccharine juice extracted, while by the larger one a larger quantity of saccharine juice will be expressed, but mixed up with much of the foreign and injurious matters before referred to.

This defect is common to all and every of the roller mills in use, and is totally irrespective of the number and position of the rollers. Further; when a cane is passing between a pair of rollers, the pressure at any one time does not extend to more than two or three inches of its length, and the extreme pinch is exerted on a mere line only, where the rollers approach nearest together—the pressure gradually decreasing on each side of the centre of pressure. Now, when rollers of two feet diameter are making ten revolutions per minute, their surfaces, and consequently anything passing between them, must be moving at a rate exceeding one foot per second; therefore, if we assume that the effective pressure upon a cane amounts to three lineal inches at one time, it is clear that one-quarter of a second only is allowed for expressing the juice from each portion of the cane under operation—a period wholly inadequate to effect the thorough displacement of the fluid from the congeries of cells in which it is contained. Neither can this evil be remedied by any alteration of position or arrangement of the rollers. Another serious defect of the roller mill, is the extraordinary facility it affords for the re-absorption of the juice after it has once been expressed. The cane, it is well known, consists of an outer rind enveloping a spongy cellular mass, which contains the saccharine juice. The spongy mass possesses a considerable amount of elasticity when deprived of the juice, and as the cane emerges from its momentary pressure between the rollers, this elasticity causes the cane to expand in the same way as sponge does when relieved from pressure, when it re-absorbs the juice which is flowing in contact with it among the rollers, and thereby not only wastes the juice, but leaves the refuse cane so saturated with it, that it is found necessary to spread the cane trash in the mill-yard to be dried by the sun before it can be used for fuel.

I have before stated that the pressure on a cane, while passing between the rollers of a mill, will always be in proportion to the relative thickness or diameter of the cane and the amount of space between the rollers; but the amount of pressure exerted upon the different parts of the cane is far from equal, since the rind and knots are more hard and woody than the rest of the cane, and there-

fore subjected to a much heavier pressure than the intermediate parts, which are composed chiefly of soft cellular matter and juice; and thus it is that so much green wax, chlorofile, and other objectionable matters are expressed from the knots and rind,

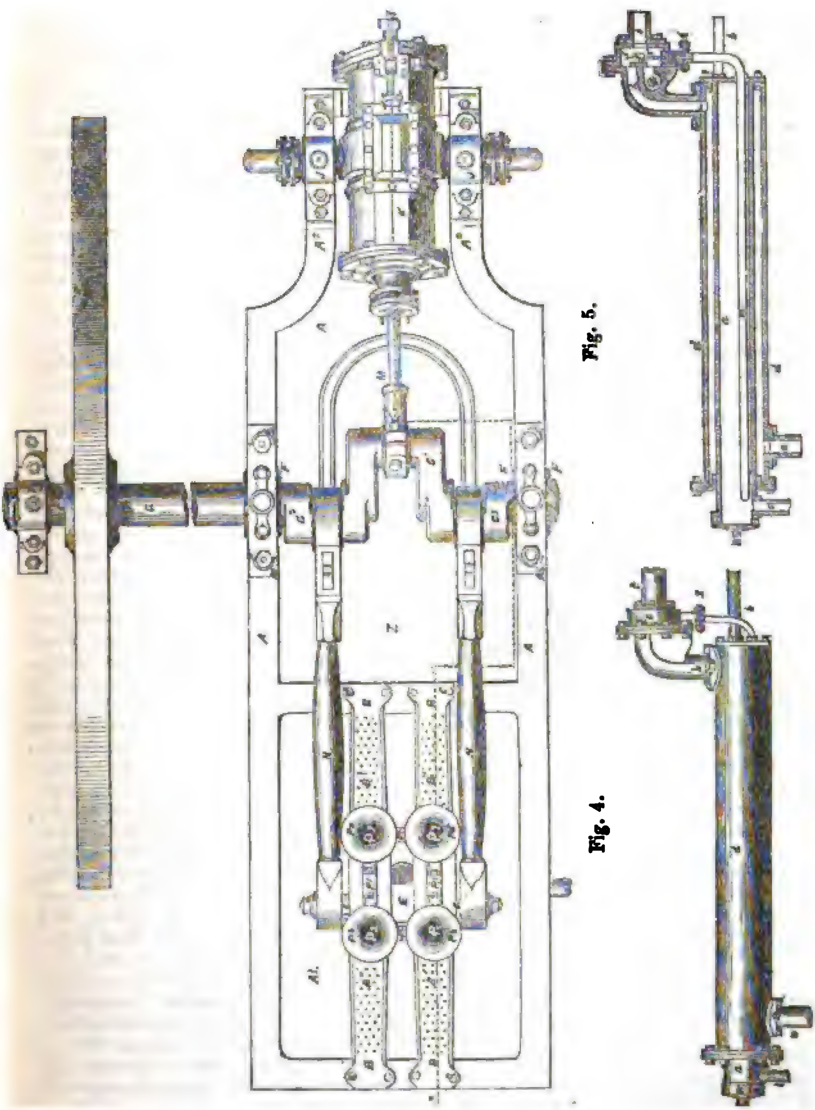


Fig. 3. Fig. 4. Fig. 5.

which should, if possible, have escaped pressure altogether. Their superior hardness and solidity cause the rollers to exert a far greater pressure upon them, by which the injurious matters before referred to are expressed, the juice greatly contaminated, and

the power of the mill absorbed. This defect is common to all roller mills, however the rollers may be varied in number or position. Lastly, the action of the rollers upon the canes, when great or repeated pressure is exerted upon them, tends to lacerate them to a considerable extent, causing thereby many of the larger fragments to fall into the juice, and forcing out and mixing with it innumerable small pieces of the delicate cellular tissues of which the structure of the cane is chiefly composed, the mixture of which with the juice greatly increases its tendency to fermentation, and impedes the process of defeccation. Having thus briefly pointed out the more prominent defects in the existing roller mills, I will now proceed to describe the means by which I propose to remedy them.

The description which follows is illustrated by drawings, from which the accompanying engravings have been made. The cane press is there represented as being combined in one framing with a steam engine, which works by direct action without the intervention of any gearing.

Fig. 1 represents a side elevation of the apparatus; fig. 2, a longitudinal section on the line *xy* of fig. 3; and fig. 3, a plan of the same. A, fig. 1, is a strong iron frame cast in one piece. At one end this framing forms a cistern, A¹, for the reception of the expressed juice, the bottom of which slopes to the centre, in order to facilitate the running off of the juice. BB are two gun-metal tubes or trunks, placed above the cistern, A¹, which have their ends firmly attached by bolts, CC, to the ends of the cistern, and are further secured thereto by the projections, WW, which are cast on the under side of the tubes, and abut against the ends of the cistern. The tubes are also prevented from springing by pillars, XX, which stand up from the bottom of the cistern, and have bolts, YY, passing up through them and screwed to a massive boss formed on the under side of the tubes. The tubes are rectangular in their cross section, and are parallel throughout internally. They are of a width sufficient to receive a cane of the largest diameter: they are made of tough gun-metal, and should be of such thickness as to be capable of withstanding a considerable amount of internal pressure. In the middle of the length of each tube there is inserted a sliding ram or piston, D, and the two pistons are connected by a cross-head, E. The crank-shaft, G, by which these pistons are worked, is made of wrought iron, and revolves in plummer blocks or bearings of brass, FF, formed in the sides of the bed-plate at A 3. The shaft is further supported by a plummer block, H, and carries the fly-wheel, I, by which the motion of the machine is regulated. The crank-shaft is shown as broken off, because its length may be made much greater than is represented in the figures, in order to remove the fly-wheel further from the machine. The end of the bed plate farthest from the cistern is narrowed at A², in order that the plummer-blocks, JJ, which support the steam cylinder, K, may be brought sufficiently near to it. The steam cylinder is of the construction ordinarily employed in oscillating high-pressure engines. The slide is worked by the levers, LL, in a manner well understood and practised. The piston rod, M, is connected to the central throw, G¹, of the crank-shaft, G. On each side of the central throw, and at right angles with it, there are other throws, G² and G³, both of which are much shorter than the one connected with the steam cylinder; NN are two connecting rods of considerable strength, each of which is connected at one end to the cross-head, E, and at the other to the crank-throws, G² and G³, so that whenever the crank-shaft, G, is made to revolve, a reciprocating motion is given to the pistons, DD. On the upper side of the tubes, BB, are fixed the conical hoppers, Pᵃ Pᵇ, which are connected together by lugs, P¹ P¹, cast on them, and terminate in holes at P², formed in the upper part of the tubes. The tubes, BB, are perforated all round with numerous small holes, B¹, which are placed at greater distances apart, towards each end of the tubes. These holes may be about a tenth of an inch in diameter on the interior of the tube, and a quarter of an inch on the exterior; the holes being made conical in order to facilitate the escape of any matter that may be accidentally forced into them from the interior. The action of the machinery is as follows:—When steam is admitted into the cylinder, K, the piston-rod acting on the crank-throw, G¹, causes it to revolve, and the two short throws, G² and G³, acting on the connecting rods, NN, and cross-head, E, impart a reciprocating motion to both the pistons, DD, at one and the same time, and these pistons move through a much smaller space and at a much less velocity than the steam piston, exerting thereby a powerful, though quiet and steady pressure on the canes in the tubes. The canes are put into the hoppers, Pᵃ Pᵇ, in a vertical position, and as the pistons, DD, move from under the hoppers, the canes fall down into the tubes, as shown at R, fig. 2. In the figures the machinery is represented as having been some time at work, and the pistons as about to make a return stroke. On the return stroke, the pistons cut off from the canes which have dropped from the

hoppers, P^a, into their respective tubes, lengths equal to the height of the tubes, and the further progress of the pistons forces the pieces so cut off against the compressed masses of cane which have accumulated at the end Q^1, of the tube. While effecting this, the opposite ends of the pistons will have passed from under the openings to the hoppers, P^b, and dropped from each of these hoppers down into the ends, Q^2 of the tubes, so that on the next stroke of the pistons, they will also cut off from the canes last dropped lengths corresponding with the length of the tube, and compressed in the same manner as before. It has been found that canes so compressed in a tube require a considerable amount of force to be exerted upon them in order to move them forward in the tube, and the resistance thus opposed to the pistons, is found sufficient to express the saccharine juice from the cane, which, passing through the perforations, B^1, is received in the cistern A^1, whence it flows through the wire grating, U, and pipe, V, into a defeccating vessel, as usual. The crank-throws which actuate the pistens, D, being placed at right angles to the throw in connection with the steam piston, it follows that as the steam engine piston acquires its most powerful position, the throws which act on the pistons, DD, will assume a position nearly horizontal, by which the force they exert will be immensely increased, and the masses of cane in the tubes yielding to the force thus exerted upon them, portions will be pushed out at the open ends of the tubes. The same advantageous position of the steam and other pistons, with reference te each other, takes place at each end of the stroke. It will also be observed that when the pistons, DD, are at half stroke, and require but a small amount of power to produce motion in them, the central or steam throw will be passing its dead points, and thus the motive power, which varies considerably throughout, is made to correspond with the work it has to perform. When the operation of pressing canes is first commenced with empty tubes, it will be found that the first two or three minutes' work will have been performed imperfectly owing to the want of resistance in the tube. It will therefore be necessary to submit this small portion of "cane trash" to a second operation, which will be effected by simply putting it again into the hoppers. When the pressure first comes upon a new portion of cane the juice is given out so rapidly, as to be projected through the perforations of the tubes with sufficient force to carry a portion of it beyond the cistern. To prevent this, a cover, formed of a bent piece of sheet copper, should be put over each of the tubes when the machine is in operation. Or, a larger sheet-metal cover may be made to extend all over the area of the cistern, and to inclose the whole of the tubes, by which means the waste of juice which would otherwise take place is prevented. (I have not shown these covers in the figures because they would greatly obstruct the view of the other parts of the apparatus.) It would be desirable to face the pistons, D, with steel, and also to let a piece of steel into the upper part of the tubes, B, at the part where the cane is cut off; or, the openings into the hoppers might be lined with a ring of steel extending downwards into the metal of the tube, and flush with the inside of it. The two cutting angles being thus formed of steel, will last longer and act better, than if left of the metal forming the tubes and pistons. I have shown in figs. 2 and 3 an opening, Z, through which that portion of the cane trash falls, which is expelled from the ends of the tubes nearest the cranks. The cane press should be placed upon a slightly elevated base, and a small arched opening should be left for the purpose of getting out the cane trash, which falls through the opening, Z. The cistern, A^1, I prefer to line with copper or lead, and the tubes, BB, to be made of an alloy of copper by which the injurious effect of iron on the cane juice is preventd. It may be desirable in some cases to act upon a much greater quantity of canes at a time, than can be done by means of the apparatus before described. In that case the tubes may be made higher, so that longer pieces of cane will be cut off at each stroke. Or, instead of this, more tubes may be employed in one machine. Or, the two arrangements may be combined, that is, larger tubes and more of them.

Although I have described a cane press as combined in one frame with a steam cylinder and appendages, it will be obvious that instead of such a combination, an ordinary steam engine may be connected to the crank-shaft of the press, or any other motive power may be so employed, the motion being in that case connected to the crank-shaft by tooth gearing.

I have described how the friction against the parallel sides of the tubes forms a resistance to the movements of the canes along them. This resistance in a parallel tube must be in proportion to its length, but the resistance may be greatly increased by contracting the aperture, which may be either done quite at the end of the tube, or the tube may be made wedge-shaped throughout. Further, in order to regulate the pressure on the canes in a tube or other

vessel, the ends at which the cane is intended to escape, may be partially or entirely closed by a door or valve, kept shut by a spring or weighted lever, so that the force required to overcome the counterpoise shall constitute wholly or in part the resistance required; and thus determine the force exerted upon the cane by the piston. The requisite contraction of the escape aperture may be readily effected by forming a portion of the sides of the tube or other vessel into doors or flaps, which may be hinged to the side of the tubes so as to unfold and form between them a parallel space equal to the size of the tube; but when inclined slightly inwards towards each other (by the force of any weighted lever upon them), they would form a wedge-shaped aperture, the size of which might be either regulated by a weighted lever or spring as before described. Or, the doors or flaps might be acted upon by screws, so as to form a permanent contraction of the aperture to the required extent.

The advantages anticipated from the preceding improvements are thus briefly summed up:

Firstly, With regard to the equalization of pressure upon canes of different diameters in the cane press, it deserves to be noticed that the pistons move an equal distance at every stroke, but that as the masses of cane which form the resisting media, slide along the tubes whenever a certain amount of pressure is exerted upon them, and will so move any required distance without any additional intensity of pressure, it follows, that as every cane, whatever may be its diameter, has to move the mass forward, an equal pressure is given to all of them, the only difference being, that when a larger cane than ordinary is put in, it causes by the insertion of its increased bulk between the piston and the rest of the canes, a greater movement of the latter. And by the same rule, however small a cane is put in, the yielding mass does not give way until the requisite pressure is exerted upon it, when it will move forward a small distance only, which in every case must be in direct proportion to the bulk of solid matter contained in the newly-interposed portion of cane. Further; the canes by this process are cut off into convenient lengths for burning, and are not lacerated, as usual, the trash, resembling flatly collapsed tubes, having a smooth and glossy external appearance. The knots sink slightly into the soft portions of those pieces which come in contact with them, and thus are not subjected to the rigid and unyielding pressure of iron rollers acting on both sides of them, instead whereof they are pressed one against each other, and consequently, although the pressure is sufficient to extract the saccharine juices, from the soft cellular interior of the cane, it is not sufficiently rigid to cause the extraction of the green wax and other objectionable matters from the knots and rind.

Secondly, With regard to the *time* which is allowed in the common rolling mill for the expression of the juice, I have before shown that in one quarter of a second after the pressure is applied, it is again entirely removed; but in the cane press before described, the pressure is continued on every portion of cane for a space of time exceeding two minutes. For it is found that canes of an ordinary diameter, occupy when under pressure in the tube about one-eighth of an inch of its length; therefore, if we assume that the piston makes sixty strokes a minute, and that the compressed cane occupies 18 inches of the length of the tube, it follows that each piece will require about two minutes and twenty-four seconds before it arrives, and is expelled at the open end of the tube. And it is this retention of pressure on the cane which causes so much of the juice to drain out of it with so little pressure, that other matters more difficult to extract are retained in the rind and knots, whereby the purity of the saccharine juice is greatly enhanced.

Thirdly, With regard to reabsorption of the juice into the pores and cells of the cane as it emerges from the rollers of an ordinary mill; it will be seen, from the operation of the cane press just described, that each piece of cane is propelled successively farther and farther along the tube. The first effort of the press brings out a large portion of juice, but as the piece of cane recedes from the piston it gets further from contact with the principal flow of juice, and continues to give out juice until it has progressed about a foot along the tube, and becomes exhausted, or nearly so. Thus the piece of cane is deprived of its saccharine juice by a continued pressure, and ample time is afforded for the juice to percolate through the labyrinth of tissues in which it is contained, while its removal under pressure prevents the possibility of reabsorption.

Lastly, Having shown how the pressure of the pieces of cane against each other, instead of the rigid pressure against iron surfaces, prevents the extraction of the green wax or other injurious matters from the rind and knots of the cane, I have only farther to remark, that instead of the pressure exerted lacerating the cane and forcing out great quantities of cellular matter and large fragments into the juice as usual, the latter is rendered impossible by the smallness of the perforations in the tube, while the deli-

cate cellular tissues are, as it were, carefully folded up in the collapsed cane, and acts as a sort of filter for the juice which continues to flow from the cane during its progress to the dry end of the tube.

The apparatus for regulating the temperature of the cane juice in its progress from the press to the defeccating vessel —which constitutes the second branch of Mr. Bessemer's improvements, is represented in fig. 4 (elevation) and fig. 3 (a section), and is thus described:—

a is a copper cylindrical vessel placed horizontally, having a pipe, *b*, leading thereto, which conveys the juice from the cane mill or press; and *c* is another pipe by which it is conveyed to the defeccating vessel, at which place the pipe, *c*, is provided with a cock to regulate the flow of the juice by the entire or partial closing of which cock the vessel, *a*, is kept always full of liquid, and the contact of the latter with the air prevented. The vessel, *a*, is inclosed in a jacket, *d*, of cast iron with sufficient space between for the circulation of steam which has previously done its duty in the steam-engine cylinder. But as it is desirable that the cane liquor should not exceed a temperature of 180° Fah., I regulate the quantity of steam passing through the jacket in the following manner: *e* is a slide box, similar to the slide box of a steam-engine cylinder; *f* is a small slide valve, which opens or closes the two steam ports, *g* and *h*. Within the vessel, *a*, there is an iron pipe, *m*, which passes from thence, and is turned upwards and connected to the slide box, *e*; the upper end of this pipe is open, and has a small piston, *n*; and rod, *r*, by which it is attached to the slide, *f*; the tube is filled with mercury, and at the flange joint, *s*, there is a piece of vulcanized India rubber inserted so as to form a cap capable of yielding to pressure and raising the piston whenever the mercury expands enough to do so. The use of the India rubber is to prevent the leaking of the mercury past the piston. The action of the apparatus is as follows: The vessel, *a*, having been filled with juice, steam is admitted to the box, *e*, through the pipe, *t*, and flows partly thence into the port, *g*, from which it escapes into the atmosphere. A portion of the waste steam passing through the port *h*, finds its way into the jacket, and finally escapes by the waste pipe, *u*, and thus heats the juice contained in the vessel, *a*. The mercury also acquiring the temperature of the juice will expand, and acting upon the slide, *f*, will regulate the quantity of steam admitted to the jacket. Thus, if the temperature of the juice rises, the mercury expanding will further close the aperture and diminish the influx of steam into the port, *h*, while it opens wider the port, *g*, and allows vent for the waste steam of the engine. The reverse action takes place, if the juice is not sufficiently heated by the contraction of the mercury lowering the slide and admitting more steam. In order to clean out the vessel, *a*, it is provided with a screw cap, *w*, which can be removed, and the vessel cleaned when required.

THE IMPOLICY OF CONCEALED OR INDIRECT REWARDS.

In the article on chronometers, No. 1366 of the *Mechanics' Magazine*, Mr. Loseby's improvements in them are specified, and the manner in which he has been rewarded for them by the Admiralty.

It appears that Mr. Loseby "has been in some measure anticipated by Mr. Eiffe, and the agent he adopted has already been applied by M. Le Roy; yet the means by which Mr. Loseby employed that agent were *new* and *very ingenious*"—and as they were so, surely they merited specific reward. The Admiralty, however, only remunerated him in a *concealed* way by the purchase of thirteen of his chronometers, for which they paid him 630*l*.

In this case, what was the estimated amount of the reward intended? Was it considered that a profit beyond the fair mercantile compensation to a manufacturer would be charged? If so, to what amount was the expected excess? Would it be 25 per cent., some 150 guineas; or say 50 per cent., 300 guineas? Would either of these sums have been thought excessive, if given openly and specifically for such "new and ingenious" improvements in an instrument so essential in navigation as the chronometer?

The hydrographer of the Admiralty has said that "ultimate success, however, could not be proved by short artificial trials at home; and therefore the Admiralty, though refusing him a direct reward, have afforded him by spreading his chronometers through all climates, the best and most satisfactory means of establishing the merits of his invention." A just observation, and which might

have afforded cogent reasons for postponing all reward, till those merits should have been fully ascertained; but in fairness to other competitors, chronometers of each of the kinds which at Greenwich had on trial stood high in point of merit, ought to have been equally subjected to similar experience in all climates.

Manufacturers cannot but be much injured, when a reward for a specific improvement is given under the shape of an order for a considerable number of the article in which that improvement is only one of the component parts. In this case, purchasers of chronometers looking to the Admiralty as high authority, will naturally conclude that those of Mr. Loseby are of superior manufacture, or at least of lower price, than those which can be obtained from any other maker. The public generally will not advert to the fact, that the order for a large number was given to him on account of "circumstances other than the position which that gentleman held in the competition." Whether Mr. Loseby's chronometers be or be not, in point of materials and manufacture, superior to those of other makers, it does not follow that the originator of a happy invention should necessarily excel as a manufacturer.

But it is to the public generally that blame should attach for such sinister modes of giving reward. When the Admiralty, for instance, give openly remuneration for specific service, the public voice attributes it either to favouritism, or to motives that are corrupt; hence the disposition to give rewards under concealed instead of open forms; and this mischief results to the public, that they often have to pay immensely under the blind of a contract, for some article, where the invention would have been by its originator thought amply remunerated by such a sum as fifty or a hundred pounds.

B.

FLOW OF GAS THROUGH PIPES.

Sir,—In no department of gas engineering is there more need of experimental information than in that of the flow of gas through pipes, inasmuch as the results given us by rule do not agree with those found in practice.

I believe that the same inconsistency holds in regard to the flow of water and other fluids; but my experience being confined to gas, I will limit my observations to that branch of the subject.

I have read the best works upon the subject, and had the private opinions of the most eminent engineers, and, with one exception, I have been told that, for the difference of length, the discharge will be inversely as the square roots of the lengths, and that, for different diameters, the discharge will be directly as the squares of the diameters.

To take an instance:—A pipe, 6 inches in diameter and 500 yards long, is found to deliver 3,686 cubic feet; whereas the same pipe, if extended to 1000 yards in length, will only deliver 2,606 cubic feet. This has been proved by experiment, and we will assume it to be correct.

But we are told that a pipe, 12 inches in diameter and 500 yards long, will deliver only 14,744 cubic feet; or, if extended to 1000 yards in length, its discharge will be reduced to 10,424 cubic feet. In both cases it will be observed that the amount said to be delivered by the 12-inch pipe is exactly four times that delivered by the 6-inch pipe, or as the square of the area; and here I disagree with those who have written before me.

In a calculation of this kind there are involved a great many intricacies; but I will pass over those minor considerations, such as the friction of the particles one against another, &c., which theory, perhaps, more than practice, would lay stress on, and merely advert to what appear to be the main causes requiring notice,—namely, the gravitating power or inertia of the gas, and the surface against which it has to rub during transmission, these having to be overcome by the force or pressure employed.

Let us see then how this applies in the case before us. A pipe, 6 inches in diameter, is, in circumference, 18·8496 inches; and four such pipes equal in capacity to one 12-inch pipe, are in circumference 75·3984. Now, a pipe 12 inches in diameter is, in circumference, 37·6992 inches, or just one-half; so that in one case we have double the rubbing surface which we have in the other. Under such circumstances, I pronounce it physically impossible that the discharge can be the same.

I am aware that some modern writers have remarked that there will be a slight advantage in favour of the larger pipe, from the cause I have just mentioned; but I contend that a passing notice of such an important point is not enough, inasmuch as large pipes, from 12 to 16 and 18 inches in diameter, will deliver from 40 to 70 or 80 per cent. more than the rule gives.

We have found that when the 6-inch pipe was 500 yards in length, it delivered 3,686 cubic feet, and when extended to 1000 yards in length, its delivery was reduced to 2,606 cubic feet. Now, in thus extending the pipe, what did we do? Why, increase the rubbing surface. We thus have a rule for calculating the effect of length friction, while side friction is entirely overlooked, just as if there was any important difference between the one and the other.

For the reasons above stated I have been led to add one additional rule, viz., *that the discharge will be inversely as the square root of the rubbing surface.* A 12-inch pipe, therefore, will deliver at 1000 yards length 14·731 cubic feet, an addition of 41 per cent. The difference appears more conspicuous in very large pipes; thus an 18-inch pipe is reckoned to deliver, at 1000 yards, 23,454 cubic feet, whereas, by my calculation, it will deliver 40,677 cubic feet.

I am not able to say that I have proved this rule by experiments expressly made for the purpose; nevertheless, I am prepared to say that it agrees with my experience of the action of large pipes better than any other rule I can apply. I therefore throw it before your readers to receive their scrutiny, and shall be happy to hear of any rule that will answer existing objections better.

GEO. ANDERSON.

October 18, 1849.

SIR JOHN F. W. HERSCHEL'S OUTLINES OF ASTRONOMY.

(Concluded from page 370.)

We have given only a very imperfect account of what the Herschels have done for British science, and we are quite conscious how inadequately we have ascertained the claims of George the Third to the nation's gratitude for his truly princely patronage of Herschel, for his sterling and abiding friendship for that celebrated man. We feel, moreover, that we have failed to set out all that the Herschels have done in return to elevate this country in the scale of intellectuality: ours is only a defective attempt—a large volume would be insufficient to do the subject justice.

We must now turn to the book named at the commencement of this article. In 1833, Sir John Herschel published his Astronomy, forming a volume of "Lardner's Cyclopædia." There was nothing like it in the English language, and for this reason—there had been no other Sir John Herschel to write such a work. This little manual has done more towards disseminating a correct knowledge of astronomy amongst all classes of readers than all the costly volumes of astronomy that had previously been written. Mr. Macaulay, said in his speech to the Edinburgh students some time ago, "I doubt not that a copy of Sir John Herschel's beautiful work on Astronomy will be found in your Institution. A very few evenings spent on the perusal of the volume, will not, it is true, enable the student to cast the nativities of your children—but it will, I believe, give him a far more correct and more profound notion of the solar system, and of the laws which govern the universe, than the greatest astronomer of the thirteenth century possessed." This justly celebrated orator never uttered a truer sentence. However, sixteen years have elapsed since this meritorious book was published. The knowledge of astronomy, in the interim, has been vastly extended by the author and others. To bring that knowledge, and all other knowledge bearing on the subject, within the reach of English readers generally, Sir John, true to the principles which have actuated him from the commencement, of doing all he can to advance Great Britain in the scale of intellectual power—has published his "Outlines of Astronomy."

The nature of the work is best explained by the author; who says, in the Preface, "The work here offered to the public is based upon, and may be considered as an extension, and, it is hoped, an improvement of a trea-

tise on the same subject—forming Part 43 of the "Cabinet Cyclopædia," published in the year 1833. An opportunity having been afforded me by the proprietors, preparatory to its re-appearance in a form of more pretensions; I have gladly availed myself of it, not only to correct some errors, which, to my regret, existed in the former volume, but to remodel it altogether (though in complete accordance with its original design as a *work of explanation*), to introduce much new matter in the earlier portions of it; to re-write upon a far more matured and comprehensive plan the part relating to the lunar and planetary perturbations; and to bring the subjects of sidereal and nebular astronomy to the level of the present state of our knowledge in these departments." * *

The chief novelty in the volume, as it now stands, will be found in the manner in which the subject of perturbations is treated."

The fact is, the author has selected every thing that was valuable and interesting in his first work, and made it fit in with matter of like, and even surpassing value, and interest, so as to fill a volume of many times the bulk of the former.

The following is a sketch of the contents; but each chapter, besides the heads mentioned, contains a complete exposition of all the topics usually classed under these heads—every chapter, in fact, forms a little treatise on the subjects therein discussed.

Should our readers have learned to practice the following excellent advice from the *Introduction* of the first edition, it will greet them here like an old and valued friend. If they have not met with it before, we press it upon their attention, and advise them as speedily as they can to peruse carefully the whole introduction, which is replete with the same valuable counsel: the student would profitably spend the time it would occupy were he to commit the whole to memory.

"Every student who enters upon a scientific pursuit, especially if at a somewhat advanced period of life, will find not only that he has much to learn, but much also to unlearn. Familiar objects and events are far from presenting themselves to our senses in that aspect, and with those connections under which science requires them to be viewed, and which constitute their rational explanation. There is, therefore, every reason to expect that these objects and relations, which, taken together, constitute the subject he is about to enter upon, will have been previously apprehended by him at least imperfectly, because much has hitherto escaped his notice which is essential to its right understanding, and not only so, but too often also erroneously, owing to mistaken analogies, and the general prevalence of vulgar

error. As a first preparation, therefore, for the course he is about to commence, he must loosen his hold on all crude and hastily adopted notions, and must strengthen himself, by something of an effort and a resolve for the unprejudiced admission of any conclusion which shall appear to be supported by careful observation and logical argument, even should it prove of a nature adverse to notions he may have previously formed for himself, or taken up, without examination, on the credit of others. Such an effort is, in fact, a commencement of that intellectual discipline which forms one of the most important ends of all science. It is the first movement of approach towards that state of mental purity which alone can fit us for a full and steady perception of moral beauty as well as physical adaptation. It is the 'euphrasy and rue' with which we must 'purge our sight,' before we can receive and contemplate as they are the lineaments of truth and nature."

"There is no science which, more than astronomy, stands in need of such a preparation, or draws more largely on that intellectual liberality which is ready to adopt whatever is demonstrated, or concede whatever is rendered highly probable, however near and uncommon the points of view may be in which objects the most familiar may thereby become placed."

In a work so completely filled with excellencies, it is difficult to find parts to cite. All the materials of the work are the best of their kind—they are skilfully selected from a storehouse of information which contains every thing of the sort at present to be obtained. The work is a condensation of matter, most useful and interesting, and the whole is placed before the reader in language which is lucid, elegant, and exactly *rad rem;* the very best words are put in the most proper places. The author's aim, from the beginning of the work to its end, was to diffuse the most knowledge of the best kind in the smallest space: there is not a single page of the rather bulky volume which is not full of strong evidence to confirm this assertion. Open the book where you may, read any one of the 650 pages, and you will find each brimful of that species of information which only the highest order of minds can convey—and which even they diffuse, only when they are intensely solicitous, that their fellow men shall derive the greatest benefit possible from their rich stores of information.

There is one peculiar excellence in this work: the author familiarly takes hold of the reader, and does not let him go, until he has made him thoroughly acquainted with whatever he wishes him to know. If a complete master of mechanics, scientific, theoretical, and practical, were to take an intelligent friend—one whom he desired to imbue with a useful knowledge of what he saw—to a set of machinery, and were he to point out to him the nature of every lever, pulley, and wheel, and explain to him how the one acted on the other—how the one increased motion, and the other regulated it, and what the result of the whole combination is—the supposed friendly instructor, would exactly act the part, which our author has performed throughout this volume. He has explained the motion of the earth, planets, and stars precisely in this way. One sees all that he says; the subjects explained are as clear to the mental vision as though they were actually and bodily viewed.

When the author is describing the Milky Way, he seems to take the reader to some eminence above that celestial region—to spread out all its glories—and to explain to him the ground-work and nature of the whole. Admitting the whole system of the universe to be a stupendous piece of machinery, the author takes his reader throughout the whole, just in the same manner as we have supposed the mechanist to take his friend through a set of machinery. We are not acquainted with any other writer who has attempted such a task; we much doubt whether there be another who could perform it with the like success. We believe that Herschel is the only Englishman who could complete such an undertaking, and that there is no Herschel in any other country that can be set up as a rival.

We now proceed to give a few more extracts, taken almost at random; we cannot follow our wish to lay the whole before our readers—we trust, however, that all of them will carefully read the book; that all who can will buy it; and that any one who cannot afford to buy will borrow it.

The Sphere of the Heavens.

"The ideal sphere without us, to which

we refer the places of obects, and which we carry along with us wherever we go, is no doubt intimately connected by association, if not entirely dependent on that obscure perception of sensation in the retinæ of our eyes, of which, even when closed and unexcited, we cannot entirely divest them. We have a real spherical surface within our eyes, the seat of sensation and vision corresponding, point for point, to the external sphere. On this the stars, &c., are really mapped down, as we have supposed them in the text to be, on the imaginary concave of the heavens. When the whole surface of the retina is excited by light, habit leads us to associate it with the idea of a real surface existing without us. Thus we become impressed with the notion of a *sky* and *heavens*, but the concave surface of the retina itself is the true seat of all *visible* angular dimensions and angular motion. The substitution of the *retina* for the *heavens* would be unknown and inconvenient in language, but it may always be mentally made." (P. 60.)

A Practical Mode of Ascertaining the Rate of a Clock.

" All the *stars* are found to be unanimous in giving the same exact duration of 23h., 56′, 4·09″ for the *sidereal* day;" this being the case, to ascertain the rate of a clock or watch, " an observer need only station himself to the north of some well-defined vertical object, as the angle of a building, and placing his eye exactly at a certain fixed point (such as a small hole in a plate of metal nailed to some immoveable support), notice the successive disappearances of any star behind the building by a watch—taking care that the part of the edge behind which the star disappears be quite smooth; the verticality of the edge should be secured by the use of a plumb line." (Pages 84, 85.)

Halley's Quadrant or Sextant,

" So called from its reputed inventor, though the priority of the invention belongs undoubtedly to Newton, whose claims to the gratitude of the navigator are thus doubled, by his having furnished at once the only theory by which his vessel can be securely guided, and the only instrument which has ever been found to avail in applying that theory to its nautical uses. Newton communicated the invention to Halley, who suppressed it. The description of the instrument was found after his death among his papers in Newton's own hand-writing." (P. 115.)

Trade Winds.

" These mighty currents in our atmosphere, on which so important a part of navigation depends, arise from, firstly, the unequal exposure of the earth's surface to the sun's rays, by which it is unequally heated in different latitudes; and, secondly, from that general law in the constitution of fluids, in virtue of which they occupy a larger bulk and become specifically lighter when hot than when cold. These causes, combined with the earth's rotation from west to east, afford an easy and satisfactory explanation of the magnificent phenomena in question." (P. 146.)

On Finding the Difference of Longitude by Clocks.

Suppose two observers at distant stations, A and B, each independently of the other, to set and regulate his clock to the true sidereal time of his station. It is evident that if one of these clocks could be taken up without deranging its going, and set down by the side of the other, they would be found on comparison to differ by the exact difference of their local epochs; that is by the time occupied by the equinox, or by any star in passing from the meridian of A to that of B; in other words, by their difference of longitude expressed in sidereal hours, minutes, and seconds." (P. 155.)

A chronometer may be used instead of the clock, and thus the difference of longitudes obtained.

The Milky Way.

" This remarkable belt has maintained from the earliest ages the same relative situation amongst the stars; and when examined through powerful telescopes is found, wonderful to relate, *to consist entirely of stars scattered by millions.*" (P. 182.)

Precession of the Equinoxes.

The visible effects of the precession of the equinoxes on the aspect of the heavens consists in the apparent approach of some stars and constellations to the pole, and the recess of others. The bright star of the Lesser Bear, which we call the Polar Star, has not always been, nor will always continue to be, our Cynosure; at the time of the construction of the earliest catalogues it was 12° from the pole—it is now only 1° 24′, and will approach yet nearer to within half a degree, after which it will again recede, and slowly give place to others which will succeed in its companionship to the pole. After a lapse of about 12,000 years the star χ, *Lyræ*, the brightest in the northern hemisphere will occupy the remarkable situation of a pole star. At the date of the erection of the Great Pyramid of Gizah, which precedes by 3970 years the present epoch, the longitudes of all the stars were less by 55° 45′ than at present. Calculating from this datum

the place of the pole of the heavens among the stars, it will be found to fall near χ, Draconis; its distance from that star being $3° 44' 25''$, that star was therefore the pole star at that epoch." (Pages 191, 192.)

On Viewing the Moon.

"A circle of one second in diameter as seen from the earth on the surface of the moon contains about a square mile. Telescopes, therefore, must yet be greatly improved before we can expect to see signs of inhabitants as manifested by edifices or by changes on the surface of the soil." (P. 261.)

Sir William Herschel's telescope, with a power of 6450, it is said, brought the moon within 38 miles of the earth. Should Lord Rosse's telescope bear a power of 12,000, it will bring the moon within about 19 miles of the earth when in perigee. Sir James South is reported to have said that Lord Rosse's telescope enables one to look *into the moon.*

Weight of a Body on the Earth and Sun.

"A mass weighing 12 stone, or 168 lbs., on the earth would produce a pressure of 4687 lbs. on the sun." (P. 262.)

Kepler's Third Law.

"The squares of the periodic times of any two planets are to each other in the same proportion as the cubes of the mean distances from the sun. The expression for this law requires a slight modification when we come to the extreme nicety of numerical calculation for the greater planets, due to the influence of their masses. The correction is imperceptible for the Earth and Mars." (P. 295.)

Kepler's Second Law.

"The Second Law of Kepler, or that which asserts that the planets describe ellipses about the sun, as their focus involves as a consequence the law of solar gravitation, or whatever be the force which urges them towards the sun as exerted on each individual planet apart from all connection with the rest." (P. 298.)

Lord Brougham conceives that too much is ascribed to Kepler with respect to this second law, which he rested on empiric grounds, and which he applied only to the single case of the sun.—See an interesting discussion on this matter in Lord Brougham's "Analytical View of the Principia." (P. 254.)

The Relative Magnitudes and Distances of the parts of our System.

Choose any well-levelled field or bowling-green. On it, place a globe 2 feet in diameter, this will represent the Sun; Mercury will be represented by a grain of mustard seed seen on the circumference of a circle 164 feet in diameter for its orbit. Venus a pea on a circle 284 feet in diameter. The Earth also a pea on a circle of 430 feet, Mars a rather large pin's head on a circle of 654 feet. Juno, Ceres, Vesta, and Pallas, grains of sand in orbits of from 1000 to 1200; Jupiter a moderate sized orange in a circle nearly half a mile across; Saturn a small orange on a circle four-fifths of a mile; Uranus a full sized cherry or small plum upon the circumference of a circle more than a mile and a half; and Neptune a good sized plum on a circle about two miles and a half in diameter. As to getting correct notions on this subject by drawing circles on paper, or still more from those very childish toys called orreries, it is out of the question. To imitate the motions of the planets in the above-mentioned orbits, Mercury must describe its own diameter in $41''$, Venus in $4' 14''$, the Earth in $7'$, Mars $4' 48''$, Jupiter in 2h. $56'$, Saturn in 3h. $13'$, Uranus in 2h. $16'$, and Neptune in 3h. $30'$." (P. 323.)

Comets.

"The great number of comets which appear to move in parabolic orbits, or orbits at least undistinguishable from parabolas, during their description of that comparatively small part within their range of visibility to us, has given rise to an impression that they are bodies extraneous to our system wandering through space, and merely yielding a local and temporary obedience to its laws during their sojourn." (P. 376.)

Mr. Perigal, at one of the Marquis of Northampton's *soirées*, some time ago, exhibited an instrument to develope a peculiar law of compound motion generating *retrogade* or *recurrent* curves by a complicated system of wheel-work. Mr. Perigal said, "that one of his objects was to exhibit the parabola in the novel character of a *retrogressive* or *recurrent* curve of definite range, whence he inferred *that if a comet moved in that curve*, it might return after it had performed its allotted journey, and continue to visit us periodically."

A very ingenious paper, entitled "A Rule for Formulizing by the Binomial Theorem

Epicyclical Curves with one moving Circle," was published in the *Phil. Mag.* for June last, by S. M. Drach, Esq., F.R.A.S. An appendix was published in the supplemental number of the magazine, referring to Mr. Perigal's curious mechanism. Mr. Drach has since circulated the article in a tract. We refer to the subject because we think it deserves attention. The supposed periodicity of a body moving in a parabola should be satisfactorily settled one way or the other, because, if it can be established, it will occasion a new era in cometary astronomy. In *appearance*, at all events, Mr. Perigal's mechanism shows that the parabola is recurrent. Mr. Perigal considers that the body which moves in a parabola advances and recedes in the same track. We give no opinion, one way or the other; but we would refer the reader who is curious in such matters to Mr. Drach's papers.

The Magna Charta of our System.

"A relation has been demonstrated by Lagrange, between the masses, axes of the orbits, and eccentricities of each planet, which has claimed for it the above distinction, viz., *that if the mass of each planet be multiplied by the square root of the axis of its orbit, and the product by the square of its eccentricity, the sum of all the products throughout the system is invariable*; and as, in point of fact, this sum is extremely small, so it will always remain.

Now, since the axes of the orbits are liable to no secular changes, this is equivalent to saying that no one orbit shall increase its eccentricity unless at the expense of a common fund, the whole amount of which is, and must for ever remain, extremely minute.

"There is nothing in this relation, however, taken *per se*, to secure the smaller planets—Mercury, Mars, Juno, Ceres, &c. —from a catastrophe, could they accumulate on themselves, or any one of them, the whole amount of this *eccentricity fund*. But that can never be; Jupiter and Saturn will always retain the lion's share of it. A similar remark applies to the *inclination fund*. These *funds*, be it observed, can never get into debt. Every turn of them is essentially positive." (P. 453.)

"*The Perturbations of Uranus by Neptune.*"

The reader may find, under this head, the clearest and most complete exposition of this intricate subject which has been published. The figure in the plate most aptly and uniquely illustrates the text; the carefully written descriptive part, together with the plate, take the reader, as it were, up to the planets, and enable him to see in what manner the one influences the motions of the other. The author has lucidly narrated the outlines of the discovery of Neptune; but he has cautiously abstained from entering upon the peculiar circumstances that attended the discovery, and which have occasioned some controversy that is not yet at an end. We consider the gifted author incapable of doing injustice to any one in such matters; we therefore wish he had entered minutely upon the question, and given his decided opinion upon each of its singular points. However, there are perhaps many reasons why he could not consistently do this. Friends, long known, and no doubt highly—almost affectionately, esteemed—might be concerned; strings must, therefore, have been touched which very likely would have jarred disagreeably among many intimate acquaintances. We well know that old friends, long known—long tried, perhaps long valued—are too precious a commodity to be put in jeopardy, by canvassing a topic which may affect some of them most tenderly. Besides, the peculiar feelings of Mr. Adams upon the matter may have been known, and therefore the author might not be desirous of proving in his own case, that gentleman's peculiar and now rather notorious notions of gratitude, by any generous attempt to do justice to his undoubted claims.

With one or two of the author's remarks on this head we do not agree; but as we intend to enter into all the minutiæ of the singular discovery, with the view of doing justice to all parties *as well as to ourselves*, we shall abstain from any comment now; we wish at present simply to acknowledge a debt that we owe respecting this matter, which would have been paid, together with good interest, long ago, had not some *promissory notes*, put in circulation by our friends on "*the other side*," induced us to delay. However, our creditors may be of

good cheer; the statute of limitation has not yet begun to run, and we still hope, in due time, to be quits with them.

Taking the mass of the Sun to be 1, Professor Pierce makes the mass of Neptune $\frac{1}{19840}$; Struves' mass, $\frac{1}{14498}$; Le Verrier's theoretical planet mass, $\frac{1}{9322}$. The mass, according to the table on page 648, is $\frac{1}{18780}$. The mass obtained by the indefatigable Mr. Hind, a gentleman who at present is doing much in maintaining the national credit for practical astronomy, from the observations of the planet's satellite made by Mr. Lassell and others, is $\frac{1}{17900}$. [See notice of the R. A. S. for June last.]

We had intended to give the author's views on double stars, nebulæ, &c., which are historically associated with the name of Herschel; but we must come to a close. Our present task has been a labour of love, and we have endeavoured to give our readers some notion of the value of the work. We have aimed at picking out a few gems as specimens, yet we are fully aware that any one, by opening the book at random a sufficient number of times, may alight on parts perhaps more highly deserving notice; the work is full of them: it is tesselated throughout in the most masterly manner with the most varied and richest pieces of information; and it would be difficult to exchange a single piece for a better one.

It is said that this work is to close the author's labours in the cause of astronomy: we would fain hope not. Of one who has done so much it seems really importunate to ask more; yet, on behalf of the national scientific credit, for which, from his youth, the author has been labouring—we name physical astronomy. The treatise in the *Encyc. Metrop.*, touched up so as to bring it on a level with the present volume, would be nationally useful;—we have nothing like it, and the public want it.

It can hardly be hoped—yet we wish—that Sir John could be induced to treat the figure of the earth. His own peculiarly happy mode of handling that difficult subject would furnish a most valuable treasure to such English mathematical students as have to teach themselves. Airy's work on this subject, in his Mathematical Tracts, has met with deserved success; still we consider that many parts of it might be rendered more easily comprehensible to self-teaching students. Airy's treatise will do very well, when a tutor is at your elbow, to explain difficulties and to smooth down rugged obstacles; but we want some one of the Herschel stamp to take the student on with him, and familiarly to open his understanding as he proceeds.

Who can arrive at the end of a work like the volume before us, and not feel a hearty wish that the author had the highest honours conferred on him which the country can bestow? What genuine dignity it would be to the British peerage if it were adorned with the name of Herschel!—what an eternal honour it would be to the nation which placed it there! And why should not Nature's loftiest nobles be ennobled by our dispensers of honours? Does mere fortune stand in the way? That reason is preposterously absurd whilst the country is paying tens of thousands annually to the descendants, however worthless, of wholesale human butchers, and to the heirs of once fortunate speculators in the trade of politics. We trust the time is not distant when the nation will have the common sense to bestow its choicest honours on those rarely gifted sons who are sent by Providence to enlighten mankind,—that it will not much longer heap its wealth and honours only on the most fortunate players at the game of cut-throats, and on clever hoodwinkers who have grovelled their way up through duplicity and chicanery. At present almost the only distinction which the public bestows on scientific talents or literary acquirements which have gained a European fame, is a KNIGHTHOOD—a kind of offal honour which is thrown to any bumpkin militia officer, or fastened, as a sort of fool's-cap, on any booby mayor of a borough, for accomplishing the wonderful feat of carrying up an unintelligible address to court. We trust that genius, and talent, and high acquirement will not hereafter be insulted by such rewards. We

hope the day is not far off, when the country will bestow its best gifts on those to whom it is most indebted for all its real greatness.

MR. TATE'S EUCLID.*

We were amongst the first to introduce Mr. Tate's writings to the public in the shape of a review; and we did it in an honest spirit of encouragement to his opening abilities. We know also that our commendation of his labours has operated somewhat in his favour, in quarters where it was of personal advantage to him to stand well. We do not regret this; but we do regret to say, that the character of some of his recent productions should be such as to create great regret at a certain change which has come over the author's spirit. Traces of scientific heresy have been apparent some time; and though in speaking of what was good in those works, we kindly forebore to censure what we could not but disapprove, it was under the hope that the said heresy was more in appearance than in reality.

When we first saw Mr. Tait's name announced as the editor of a new edition of Euclid, we were unfeignedly amazed. For, but a brief year had passed, since to our vivid recollection, he had been at some pains to show in the preface to his "Principles of Geometry," that it was high time Euclid should be shelved! Our amazement was not diminished, on turning to this new edition to see it gravely affirmed by Mr. Tate that he had undertaken the task of editor "with the *hope that it may tend to advance the mathematical education of the country.*" So opposite is this profession of faith to that which he avowed last year, that it may be fairly reckoned amongst the most remarkable scientific conversions on record. "Ratting" may be only too common in political life: but in scientific life such ratting as Mr. Tate's is without a parallel—at least to the extent of our reading and observation.

The reason for the change is not far to seek. The Council of Education has decided upon giving *certificates to those* SCHOOLMASTERS *who can cram up* THREE *Books of Euclid!* Mark the number, *three.* Mr. Tate supplies just the *three* required; he rats only to the extent needful to suit the views of the Council. The Council certificate will certes be a valuable document; and we have no doubt the public will duly esteem and honour those gifted members of the scholastic profession who are honoured with its possession. Three books of Euclid! What next? We have seen many strange doings of this Committee of the Privy Council; but we were not prepared for anything so outrageous as this. What, by the way, will the "College of Preceptors" say to this invasion of their chartered *diploma system?* It certainly does seem strange that the Government should grant a charter to this body; and then, as if repenting its indiscretion, enter the market with a cheaper ware—more easy of purchase, and more imposing upon the public. Is there no Member of the People's House sufficiently independent and sufficiently well informed, to ask the minister for an explanation of this singular confusion of measures?

We could have understood Mr. Tate, and have relieved him of all blame, too, had he been a government *employé*, and been "ordered to prepare an edition of Euclid," or to "compile" any other book which his official superiors might, in their sublime wisdom, have thought requisite for the instruction of the rising generation. Here, however, there is no such plea. Mr. Tate is in a position independent of the Government; and it is not even pretended that he was *requested* to publish such a work, except perhaps in Paternoster-row. The stultifying act is wholly his own; and whatever may be the penalty to his reputation, he has voluntarily incurred it. The naked fact appears to be, that there was a prospect of "making money" by the thing; and possibly it may turn out so, though it is by no means certain that he has this time "hit the right nail." If it turn out even better as a specu-

* The first three Books of Euclid's Elements of Geometry, from the text of Dr. Robert Simpson, together with the various useful Theorems and Problems as Geometrical Exercises on each Book. By Thomas Tate, Mathematical Master of the National Society's Training College, Battersea. 1849.

lation than he has anticipated, he pays a price that, to a high-minded man, would be frightful, for the advantage. This is, however, for his consideration, and, we may add, for the warning of others.

Why Mr. Tate should prefix his name to this edition of Euclid, we are at a loss to conceive — unless it be a belief that anything and everything with which his name is connected will "sell." It may be a somewhat vain and arrogant view for him to take; but we cannot conjecture any other. We have to ask, however, *what right* has he, to this employment of his previous reputation, *to sell a book which is no more his than ours?* If the expiry of copyright has put it in the power of any man to print Simson's translation, we cannot admit the reader of the proofs to have any right to place his name on the title page. Has Mr. Tate done more than this?—Scarcely. A series of "useful theorems and problems" are added at the end, which the aspirants for the Council certificate will doubtless find "very hard," and think "very clever," and, in their simplicity, put down as "*very original.*" For any distinct manifestation of this last quality in those theorems and problems, we could have forgiven Mr. Tate much else; but we look for it in vain. We have gone with a good deal of care through these propositions, but without finding a single instance where they were not taken from other sources, and from the most easily-accessible of all sources—the editions of Euclid now in ordinary use. If Mr. Tate feel aggrieved by this statement, we would only ask him to tell us which of his propositions are original; and why, when making so free with the collections of others, he has not at least had the honesty to express his obligations?

MR. WEALE'S NEW SERIES OF RUDIMENTARY WORKS. — NO. I. HANN'S ELEMENTS OF PLANE TRIGONOMETRY.

The well merited success of Mr. Weale's two previous series of rudimentary works (embracing mechanics, natural philosophy, chemistry, &c.), has induced him to bring forward a third, which is to be devoted to mathematics. The editing of this series has been entrusted to Mr. Hann, and it could not well have been placed in better hands. The Editor has himself supplied the first of the series, which is devoted to the "Elements of Plane Trigonometry." This is not exactly beginning at the beginning; but as each treatise is to form an independent work, the order of publication is of no great importance. The work is distinguishable from others on the same subject chiefly by the number of examples, *fully worked out*, which it contains, of the different modes of trigonometrical calculation. Self-teachers will find it on this account a better guide to the practice of this branch of mathematics than, any other of equal size and cheapness that we know of. Mr. Hann has made free use of the works of preceding writers, both English and French; but, unlike some compilers, he frankly acknowledges his obligations, specifying as those to whom he has been chiefly indebted, "Bonnycastle, Cope, De Morgan, Gaskin, Hall, Hind, Hymers, Snowball, Woodhouse, Gregory, and Davies." "The problems," he adds, "have been taken principally from the *Ladies'* and *Gentleman's Diaries*, the *Cambridge Problems*, and *Leybourn's Repository*." In treating of the development of the sine and cosine, he refers with commendation, to some remarks which appeared on that subject, from the pen of our able correspondent "A. H.," in the *Mech. Mag.*, No. 1256, pp. 236-232, and ends by giving a very clever exemplification of the manner in which, in the higher branches of mathematics, "sin ϕ" and "cos ϕ" may be expressed in terms of the sine and cosine of the simple arc.

FLUSHING SEWERS.—SALTER'S PATENT.

The method of flushing seems now universally admitted to be the best which has been yet proposed for effecting a speedy clearance of sewers from accumulations of filth; and this whatever the nature of the outflow may be; whether a natural river like the Thames,

or an artificial conduit constructed for the purpose of their reception. While the question of outflow is, therefore, undergoing investigation at the hands of the Metropolitan Commissioners, we may be excused for recalling public attention to the valuable improvement in the flushing system which was patented a little while ago by Mr. R. G. Salter, (then of Liverpool, but now of Hobart-place, Pimlico,) and partially described in our last vol.

According to the mode now in use flood-gates are closed across the sewers, in order to produce a head of sewage water equal to their height, and are kept closed by means of an iron bar or strut, which is removed periodically by an attendant to allow the pent-up mass to rush forth and clear all before it. The flushing, therefore, takes place only when the attendant is present to set the flood-gates free, and as the time which it takes the sewage water to accumulate to the height of the gates varies with a thousand circumstances—all as beyond calculation as control—it follows of necessity that the gates must often remain closed long after they ought—consistently with the purpose of their construction—to be closed. In all such cases these gates may be said to do more harm than good—creating rather than removing deposits. To make the flushing system perfect, the flood-gates should open, the instant the necessary quantity of flushing water has accumulated behind them. Now this it is, which Mr. Salter has accomplished, and by means so ingeniously simple that they might be applied in a month's time to the whole of the sewers of the metropolis.

Mr. Salter hooks the end of an iron strut to the ordinary gate, and at an angle of about 45° inserts the other end into a strong staple firmly fixed in the brick-work of the sewer. The gate is thereby made perfectly fast; but in the centre of the strut there is a weighted joint, which when acted on in the following manner instantly sets it free. When the collected water has attained the given height, it is conveyed by an overflow-pipe to an iron basin which works on an axis, to which is attached a lever, extending beneath the joint in the strut, when the gravity of the water in the basin overcomes the weight of the lever, and the joint of the strut is suddenly lifted upwards, on which the accumulated body of water forces the gate open, and the strut becomes contracted into this form Λ. While the water is rushing through the sewer, the basin, by being inverted, empties itself and returns to its former position; and when the current has slackened so as to be of no farther service for flushing, the preponderating weight of the strut being upwards, it gradually falls back to its original position, and the gate is closed. The forming of another head of water is then at once commenced, to be let free as before, as soon as formed. And so the apparatus will continue working for ever (with timely repairs) without any-one's assistance to keep it going—being in fact literally self-acting.

The general adoption of Salter's apparatus would ensure, therefore, the following indisputable advantages:—

1. The flushing of sewers in the least possible time.

2. Less risk of the matters discharged into the sewers, generating deleterious gases, and of these gases escaping through the sewers into the upper atmosphere and into inhabited places.

3. A better ventilation of the sewers in proportion to the greater frequency of the flushing process; every rush of the water producing a corresponding rush of air in the direction of the outlet. And

4. A saving of all the expense attendant on the employment of persons to open the flood-gates.

Mr. Salter's invention has been applied with admitted success to the great sewer which runs through St. Giles's. Why, then, should a day be lost in extending its application to the entire metropolis? The delay, we presume, can have arisen only from the recent change of hands which has taken place in our sanitary administration. But now that the new Commission is in full action, we may reasonably hope to see an end put to that delay. We know of nothing which they could do so soon, and at so little expense, which would give half so much satisfaction, or do half so much good, as the perfecting of the flushing system, by the means now proposed.

APPLICATION OF FUSIBLE PIPES TO THE EXTINCTION OF FIRES.

Sir,—The property which fusible metals possess of melting at two degrees of heat, though long known, has hitherto been but little taken advantage of. Their first employment for any useful purpose was in the year 1796, when Sir Samuel Bentham introduced a fusible safety valve in the cooling and distilling apparatus of the *Arrow;* of late years French engineers have frequently employed such valves in steam engines; and the means of obviating some inconveniencies in their use appeared in the *Mechanics' Magazine.*

In the *Builder* of December, 1847, fusible metal plugs were proposed amongst others of Sir Samuel's contrivances, as a means of rendering automatic an apparatus for submerging a repository of valuable deeds and papers in case of fire.

A similar application of fusible metal seems desirable to a considerable extent, wherever reservoirs of water may be provided on roofs, since by carrying pipes from a water cistern to the interior of a building, and forming either portions of those pipes, or plugs upon them, of fusible metal, should fire break out, that metal would melt, and of course a flow of water would follow. So, in dwelling houses, where fire on a staircase frequently prevents the escape of the inhabitants, were such pipes from a cistern introduced as part of, or behind a cornice, for instance, the melting of the fusible metal would automatically admit water enough, supposing the apparatus judiciously arranged, to check, if not to extinguish the flame.

Fusible metals, it is well known, may by varying the proportions of the component metals, be made so as to melt at different degrees of heat, from that of boiling water upwards, so that in each instance of the application of this expedient to use that degree of fusibility most suitable might be given to the metal. The skill of both mechanists and architects of the present day, require only to be turned to the contrivance of proper arrangements, to assure the efficiency of this new expedient.

The fire-proof repositories proposed in the *Builder* were such as might be constructed either on a small or on an extensive scale, and may be likened to water-tight cisterns made, in preference, under the level of the ground. The top of the repository should also be water-tight, excepting an aperture large enough for the admission of a man; but this man-hole should have a covering to fit, water-tight. The interior of the repository fitted up with shelves for the reception of water-tight metal cases, in which the deeds or papers to be kept would be enclosed, in the same manner as was the gunpowder on board the *Arrow* and the *Dart*, 1795, and as it is now frequently kept in vessels of war. Over the whole of the receptacle, with the exception of the man-hole, a cistern of water, equal in capacity to the whole of the receptacle below, and pipes plugged with fusible metal connecting the cistern with the receptacle. Over the man-hole, when not in use, water also to be let in.

With such an arrangement, in the case of fire in adjacent buildings, of sufficient intensity to make the water in the cisterns of a boiling heat, the plugs would melt and let the water into the receptacle; thus, self-acting so far; and by similar means the cistern might be replenished from water pipes or mains. All danger over, it is needless to add, that the receptacle would be pumped dry and ventilated, when all within would be found perfectly uninjured, however great might have been a neighbouring conflagration.

The coroner's inquest on the late disaster at London-wall, adverted to the danger resulting from the use of candles in storehouses; on account of like danger in manufactories, Sir Samuel, in the wood mills at Portsmouth, exemplified the convenience and economy, as well as safety of substituting lamps for candles. The lamps he introduced in that establishment were of the invention of Mr. Grimshaw, of Sunderland; they were enclosed in glass, in such manner as to obstruct scarcely any of the light, and so contrived, as to do away danger of fire from sparks falling from the lamps, and to prevent inflammable substances from falling on the light. In the safety magazine lamps of the *Arrow*, fresh air was admitted, and foul air carried off through syphon pipes. Lampists, doubtless, would

find it to their interest were they to turn their attention to these particulars, so as to produce a portable safety-lamp of low price, convenient use, and giving a good light, such as would be suitable for carrying about in warehouses and manufactories.

M. S. B.

COMPARATIVE POWERS OF DIFFERENT GALVANIC BATTERIES.

Sir,—My attention has, from time to time, been attracted by very inconsistent statements respecting the degree of power which various voltaic batteries possess. Mr. Ward stated, at the recent meeting of the British Association at Birmingham, that Mr. Grove's arrangement is the most energetic of all batteries; that, next, in the series, stands Daniell's battery; that Smee's has less power than either of the others; though in all, the same amount of surface is exposed to the exciting fluid. Now this is very curious; for Daniell's battery has copper for the negative metal, while in Smee's arrangement platinized silver is employed, which has been stated to be the best conductor yet known. Another anomaly remains to be mentioned. It is a principle generally adopted, that to obtain the greatest energy in a voltaic battery, metals of the greatest difference in their oxidation should be employed. Then, how is it that iron and copper have been found to constitute a more powerful voltaic circle than zinc and copper?—for the difference of the affinity which zinc and copper has for oxygen is greater than that of iron and copper.

I am, Sir, yours, &c.,

D. J.

Carmarthen, Sept. 24, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 25TH OF OCTOBER, 1849.

JOHN ORMEROD, Holt-Holme Mill, near Newchurch, Lancaster, spinner. *For improvements in carding cotton and other fibrous substances.* Patent dated April 19, 1849.

Mr. Ormerod's carding engine consists of the ordinary main cylinder, around a portion of the periphery of which are arranged in pairs a number of working rollers, with a smaller cleaning roller between the working rollers of each pair. The feeding rollers and licker-in are supported in the framework in front of the main cylinder, while the doffing cylinder is similarly supported behind it. The cleaning rollers are made to revolve by a cord or band passing round a grooved pulley keyed on the axle of the cylinder, and round grooved pulleys keyed on their respective axles. Each alternate working roller is driven in the same direction as the main cylinder, while the rest are driven in the opposite one, by means of an endless band passing over grooved pulleys keyed upon their axles, and round a grooved pulley supported on a stud, bolted in a segmental slot, and driven by a pinion on the axle of the doffing cylinder. By this arrangement the cotton or other fibrous material is alternately stripped off and fed on to the main cylinder.

Between each pair of working rollers is fixed a dust collector, which is composed of two segmental metal plates joined together at right angles, and supported by set screws, with one of their concave faces towards the circumference of the main cylinder, and the other just above the second working roller of each pair. The upper part of the vertical plate of each dirt collector is capable of being adjusted at any distance from the teeth of the carding cylinder, which, when in operation, throws the dirt off it on to the horizontal plate. Similar dirt collectors are applied to the doffing cylinder, the feeding rollers, and to the licker-in.

Claims.—1. Driving some of the working rollers, placed round a portion of the periphery of the main cylinder, in the same direction as the latter.

2. The application in carding engines of the dirt-collecting apparatus, as described.

CHARLES ALEXANDER BROQUETTE, Rue Neuve St. Nicholas, St. Martin, France, chemist. *For improvements in printing and dying fibrous and other materials.* Patent dated April 21, 1849.

These improvements refer to the employment of nitrogenous compounds obtained by the decomposition of milk or the muscular parts of animals (or, in other words, to the use of the *causeum* of the ancients). The mode of application is as follows:—Ten pounds of the nitrogenous compounds are mixed with from 50 lbs. to 60 lbs. of water and 1 lb. of ammonia. The compounds are, however, first boiled for twenty minutes in a portion of the water, and when they are partially cooled down, the ammonia and remaining portion of the water are mixed with them, and the whole well stirred up together, after which they are mixed up with 3 per cent. of olive oil and 2 per cent. of an alkaline earth (by preference lime), when

they are ready for being used with a colour not injuriously affected by the lime or ammonia. Steam is then applied, to cause the compounds to coagulate on or in the texture of the fabric. The yarn may, if desired, be saturated with the compounds previously to its being woven into a fabric, which is afterwards to be dyed or printed.

Claims.—1. The employment of nitrogenous compounds in combination with an alkaline earth in the dyeing and printing of cotton and other vegetable fibrous materials.

2. The employment of nitrogenous compounds, coagulated by heat alone or by chemical agents, for the impregnation of vegetable fibre.

LOUIS VERNET, Buenos Ayres. *For a method of preserving from destruction by worms, insects, decay, and fire, certain vegetable and animal substances.* Patent dated April 24, 1849.

This invention consists chiefly in impregnating, saturating, or coating the substance to be preserved with a weak solution of arsenic, alone or combined with other materials. The solution is obtained by boiling an arsenious acid in water until it is dissolved and the fluid becomes clear and transparent. The proportion of arsenic to water is one pound to forty gallons, and care should be taken not to allow the fire to touch the sides of the boiler above the water, which would cause the arsenic to sublimate, and act injuriously on the health of the workman. The quantity of water evaporated should be replaced by the same quantity of fresh water, in order that the relative proportions above mentioned may be maintained. Or, a concentrated solution may be formed by dissolving one pound of arsenic in five gallons of water, which can be preserved for any length of time in wooden vessels until required for use, when every five gallons must be diluted with thirty-five gallons of water. The article may either be immersed in or washed over with the solution, and then dried, whereby it will acquire a thin coating of arsenic, which will be imperceptible to the senses, but a sufficient preservative against the ravages of insects, &c. Or, it may be impregnated with the solution by exhaustion or pressure. When the solution is required to dry quickly, six pounds of alum to one pound of arsenic are dissolved in it.

To preserve timber from fire, it is to be impregnated with a solution of one pound of arsenic, six pounds of alum, and ten pounds of potass, in forty gallons of water.

To preserve timber immersed in water from decay and the ravages of the worm, it is to be painted over with the solution mixed with oil or any suitable tarry matters.

Claims.—1. The use of weak, simple arsenical solutions to preserve animal and vegetable substances from insects and decay.

2. The use of weak arsenical solutions, in conjunction with other matters, or with oil or tar, to preserve animal and vegetable substances from fire and worms.

Specification Due, but not Enrolled.

WILLIAM KILNER, Sheffield, engraver. *For improvements in manufacturing railway and other axles and wheels; and in machinery to be employed in such manufacture.* Patent dated April 24, 1849.

NOTES AND NOTICES.

The Inflexible, commanded by our old and much esteemed correspondent, Captain Hoseason, has recently returned to England, after a steam service round the world, far exceeding anything yet accomplished by any other vessel, either of the Royal Navy or of the commercial marine, whether we look to the extent of the voyages performed, or to the intelligent care with which the work done and the various circumstances affecting it have been noted and recorded, or to the value of the general results deducible from the *Inflexible's* performances. Captain Hoseason has confided to us the whole of his logs, papers, diagrams, &c., for examination; and we propose to give, in an early supplementary part, a digest thereof, to which Captain H. has kindly promised to add various explanatory notes and comments of his own. We hope to be able to give this supplementary part early in the ensuing year.

Bain's Electro-Chemical Telegraph.—The New York and New England Telegraph Company is now engaged in constructing a line of telegraph between New York and Boston, under a charter from the legislature of New York, making use of Bain's invention, which has been patented by our Government. The whole line is under contract, and the section between New York and New Haven is nearly finished.—*New York Tribune.*

Use of Coloured Glasses to Assist the View in Fogs.—The following curious observation is made by M. Luvini, of Turin, in a letter to the editor of *L'Institut*, at Paris. If it be verified, it may prove to be of importance to geodetical operations, as well as in observations at sea:—"When there is a fog between two corresponding stations, so that the one station can with difficulty be seen from the other, if the observer passes a coloured glass between his eye and the eye-piece of his telescope, the effect of the fog is very sensibly diminished, so that frequently the signals from the other station can be very plainly perceived, when, without the coloured glass, the station itself could not be seen. The different colours do not all produce this effect in the same degree. The red seems the most proper for the experiment. Those who have good sight prefer the dark red, those who are short-sighted like light red better. The explanation of this effect seems to depend upon the fact that the white colour of the fog strikes too powerfully upon the organ of sight, especially if the glass have a somewhat large field. On the contrary, by placing a coloured glass between the eye of the observer and the eye-glass of the instrument, the intensity of the light is much diminished by the interception of a part of the rays; the observer's eye is less wearied, suffers less, and consequently distinguishes better the outlines of the object observed."

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22ND OF SEPTEMBER, AND 22ND OF OCTOBER, 1849.

John Mason, of Rochdale, Lancaster, machine maker, and George Collier, of Barnsley, York, manager, for certain improvements in machinery, or apparatus for preparing and spinning cotton, and other fibrous materials, and also improvements in the preparation of yarns and threads, and in the machinery or apparatus for weaving the same. Sealed, September 24; six months.

William Parkinson, of Cottage-lane, City-road, Middlesex, successor to the late Samuel Crossley, for improvements in gas and water meters, and in instruments for regulating the flow of liquids. September 24; six months.

James Aitken, of Cook-street, Glasgow, manufacturer, for certain improvements in the preparation of cotton and other yarns for weaving, and in the machinery employed therein. September 27; six months.

John Robertson, of Patterson-street, Stepney, Middlesex, engineer, for improvements in machinery for moving and raising weights. Oct. 3; 6 months.

Ernst Gapel, of Birmingham, Warwick, esq., for improvements in marine vessels, in apparatus for the preservation of human life, and in moulding, forming, and finishing hollow and solid figures, composed wholly or in part of certain gum, or combination of certain gums, also improvements in dissolving the aforesaid gums, and in apparatus or machinery to be used for the purposes above mentioned. October 8; four months.

Robert Clegg, Joseph Henderson, and James Calvert, of Blackburn, Lancaster, manufacturers, for improvements in looms for weaving. October 8; four months.

Thomas Lightfoot, of Broad Oak, within Accrington, Lancaster, chemist, for an improvement in printing cotton fabrics. October 11; six months.

William Gaspard Brandt, of 16, Compton-street, Brunswick-square, Middlesex, for improvements in the construction of the bearings of railway engines and railway carriages now in use. October 11; four months.

George Henry Dodge, of America, but now residing at Manchester, Lancaster, for certain improvements in machinery for spinning and doubling cotton, yarns, and other fibrous materials, and machinery or apparatus for winding, reeling, balling, and spooling such substances when spun. October 15; six months.

Charles Shepherd, and Charles Shepherd, junior, both of Leadenhall-street, London, chronometer makers, for certain improvements in working clocks, and other time keepers, telegraphs, and machinery, by electricity. October 15; four months.

Thomas Beale Browne, of Hamden, Gloucester, gent., for certain improvements in looms, and in the manufacture of woven and twisted fabrics. October 15; six months.

David Christie, of St. John's-place, Broughton-lane, in the Borough of Salford, Lancaster, merchant, for welding and uniting cast iron with steel and malleable iron. (Communication.) October 19; six months.

George Park Macindoe, residing at Mountblow, in the parish of Old Kilpatrick, and county of Dumbarton, for certain improvements in machinery or apparatus applicable to the preparation, spinning, and doubling or twisting of cotton, wool, silk, flax, and other fibrous substances. Oct. 19; six months.

Joseph Stovel, of Suffolk-place, Pall-mall East, Middlesex, tailor, for improvements in coats, parts of which improvements are applicable to sleeves of other garments. October 19; six months.

Frederick William Norton, of Lascelles-hall, Lepton, in the parish of Kirkeaton, York, fancy cloth manufacturer, for improvements in manufacturing plain and figured fabrics. October 19; six months.

John Combe, of Leeds, York, civil engineer, for improvements in machinery for heckling, carding, winding, dressing, and weaving flax, cotton, silk, and other fibrous substances. October 22; six months.

LIST OF IRISH PATENTS FROM THE 21ST OF SEPTEMBER, TO THE 20TH OF NOVEMBER.

James Warren, of Montague-terrace, Mile End-road, Middlesex, gent., and Willoughby Theobald Monzani, of Saint James's-terrace, Bermondsey, Surrey, gent., for improvements in the construction of bridges, viaducts, and aqueducts, and in anchors, and in drilling and boring braces. Sept. 27; six months.

Robert Plummer, of the town and county of Newcastle-on-Tyne, manufacturer, for certain improvements in machinery, instruments, and processes employed in the preparation and manufacture of flax and other fibrous materials. October 1; six months.

John Holland, of Larkhall-rise, Clapham, Surrey, gent., for a new mode of making steel. (Communication. October 6; six months.

No English Patents Sealed this Week.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Oct. 18	2061	William Bridges Adams,	Fan-field Works, Bow	Part of a railway wagon.
,,	2062	How and Dudgeon	Stepney	Domestic filter.
,,	2063	William and Richard Suggitt	Manchester	Power driving motion for a warping mill.
19	2064	Joseph Harrison	Blackburn	Heddle apparatus for looms.
,,	2065	Joseph Harrison	Blackburn	Heddle apparatus for looms.
20	2066	John Ridgway	Cauldon-place, Staffordshire	Water-closet basin.
22	2067	Alexander Grant and Brothers	Clement's-court, Wood-street, Cheapside	Stretcher and rib joint for umbrellas and parasols.
23	2068	James Rogers	Yately, Hants	Ventilating brick.
24	2069	Richard Adams Ford	Strand	Fastening of a shirt collar.
,,	2070	G. Erby	Oxford-street.	The Oxford shirt and collar band.
,,	2071	John Harrop	Sheffield, builder	Inodorous commode pan.

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

166, *Fleet-street, London; and* 99B, *New-street Birmingham.*

(Of which firm Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted.

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

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Protection for the whole of the three Kingdoms by one Act of Registration.

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Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the Provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents. 166, Fleet-street, and 99B, New-street, Birmingham; or by their Manchester Agents, Messrs. Wise and Wood, 3, Cooper-street.

Ornamental Designs also registered under the 5 and 6 Vic., c. 100.

To Engineers and Boiler Makers.

THE BIRMINGHAM PATENT IRON TUBE COMPANY Manufacture Patent Lap Welded Tubes, under Mr. Richard Prosser's Patent, for Marine, Locomotive and all Tubular Boilers. Also Tubes for Gas, Steam, and other purposes. All sorts of Iron Gas Fittings. Works, Smethwick, near Birmingham. London Warehouse, 68, Upper Thames-street.

Central Patent Agency Office, Brussels.

IT has long been the opinion of many Scientific Men, Inventors and Manufacturers, that it would be of the greatest utility to establish in some central part of Europe, a Consulting Agency Office, directed by an experienced Engineer, who might assist Inventors by his experience and advice, to procure Patents (Brevets) and prepare the requisite papers, and to promote generally the interests of his clients.

Influenced by this prevailing feeling on the subject, M. JOB DIXON, consulting Engineer, Knight of the Netherlands Lion, &c., has, at the solicitation of numerous scientific friends in England and the Continent, opened a Patent Agency Office at Brussels,

Rue d'Artifice, 84, bis, Boulevard de Waterloo,

Where orders will be received for the Procuration of Patents of Invention for the various States of Europe, and the United States of America; and where Mr. DIXON may be personally advised with on all matters relating to the Securing of Patents for Inventions or to the working of the same.

Persons favouring Mr. DIXON with their commands, may rely on the most judicious care, confidence, and dispatch.

N.B. All letters or packages to be addressed postpaid.

NOTICES TO CORRESPONDENTS.

Mr. Baines's plan shall have an early place.

For Staine's Electric Light see Nos. 1201, 1246, 1248, 1265, 1275, 1314, 1320, 1321, 1324, 1328, 1329.

Hall's Gas-Singing Patent has long since expired. It is described in the Repertory (2nd series) for September, 1818.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1369.] SATURDAY, NOVEMBER 3, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

HARRISON'S PATENT BISCUIT BAKING MACHINERY.

Fig. 1.

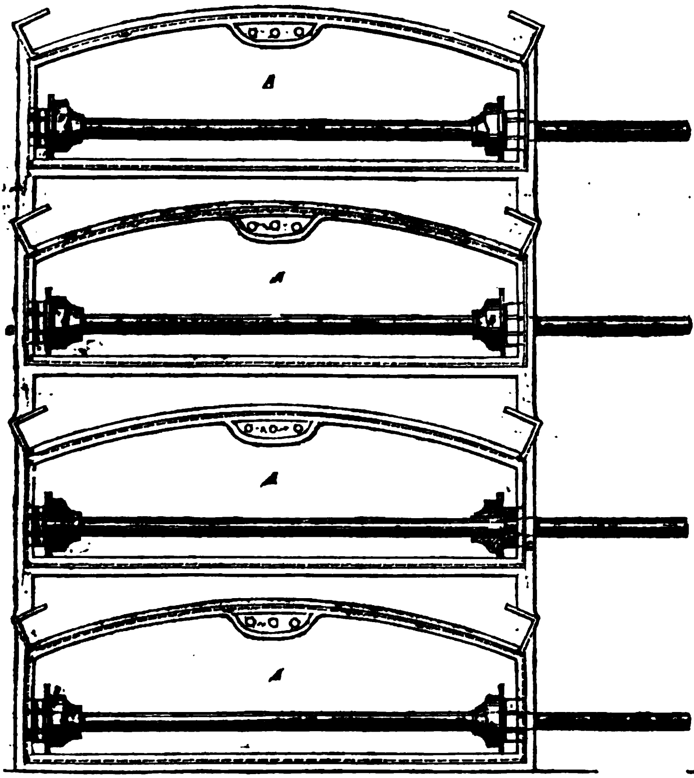


Fig. 2.

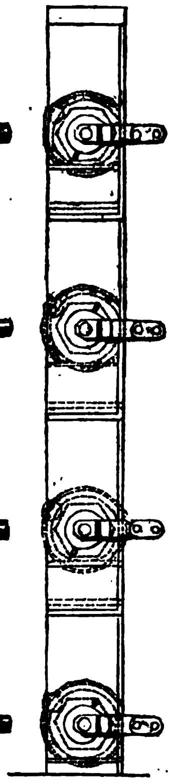
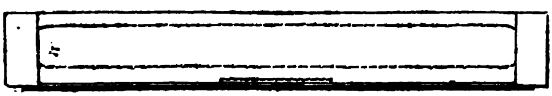


Fig. 3.



HARRISON'S PATENT BISCUIT BAKING MACHINERY.

[Patent dated March 28, 1849. Patentee Thomas Harrison, of Liverpool, merchant. Specification enrolled September 28, 1849.]

"If our forefathers," says the *Liverpool Mail*, "had been told that before they had lain long in their graves, a machine would be invented by which flour and water could be mixed together at one end, and brought out at the other in the form of ready baked biscuits, they would have doubted the sanity of the person addressing them. Yet, strange as it may seem, this is a task now in operation every working-day at the extensive ship-bread bakery of Mr. Thomas Harrison, Mersey-street, late of Wapping. Various machines are now used for the baking of ship and other biscuits, but the one patented by Mr. Harrison differs from those hitherto in use, in size, in utility, and in adaptation for the firing of the bread, of the hot-air principle, now the property of the Patent Desiccating Company. The flour and water in proper proportions are placed in a cylinder, and the first operation of thoroughly mixing is performed by arms inside. On leaving the cylinder, the dough is kneaded by means of a large iron cylinder, under which it is passed several times. The required thickness is attained on passing beneath a smaller cylinder. The dough, spread like a large sheet, passes along an endless cloth, the machinery moving at each stroke the precise width of a biscuit. As the dough passes along, by the rising and falling of a nicely-adjusted piece of mechanism, the biscuits are cut into shape and receive the stamp of the patentee. The biscuits are not circular, but six sided, and, therefore, there is not, in cutting out, any waste of dough, except a small portion at each end. Passing along the endless cloth, the biscuits are conducted to the mouth of the oven, where they are received on what may be called, for familiar illustration, an endless gridiron, which, as the machine moves, draws in the biscuits in a few seconds. Each oven is 4½ feet in width, and 26½ feet in length. There are four ovens, one above another, and all fed from the same furnace with hot water. The mixing of the flour and water occupies about twelve minutes, the kneading five or six, and the firing half an hour. As each oven contains 650 biscuits, and may be filled within a few minutes of each other, there is no difficulty in producing from flour and water no fewer than 2600 biscuits in an hour, or nearly a ton of ship biscuits every two hours. The biscuits, too, are of excellent quality—beautifully crisp and sweet. Messrs. W. and M. Scott, of the Tranmere Foundry, ar the manufacturers of the machinery."

We have now the pleasure of laying before our readers a full description of the ingenious machinery, mentioned in the preceding notice, extracted from Mr. Harrison's specification, together with engravings of the illustrative figures.

Fig. 1 is a front elevation of a set of baking ovens, constructed on Mr. Harrison's plan; fig. 2 is an end view of the front of the ovens, and fig. 3, a plan of fig. 2. AA are the ovens, which are built one over the other, for the sake chiefly of economising space and heat, and may be of any convenient number, either more or less. They are of about six times greater depth or length than breadth, and have each doors at both ends, one through which the biscuits or other articles to be baked are introduced, and the other through which the articles when baked are removed.

Each of these ovens is worked by means of an endless revolving bottom B (fig. 4), which is carried on side rollers, CC, throughout the length of the oven, and turns round larger rollers DD, at the two ends, which are driven by a steam engine, or other first mover. The articles to be baked are delivered directly from a cutting or dividing machine, such as is ordinarily used in biscuit-baking machinery, on to the endless bottom B, which takes them in at one end, and turns them out at the other.

A plan of this bottom is given in fig. 5; MM is one of two side chains, each of which is formed of single and double links, *a* and *b*, connected by pins, *c c*, like the chain of a watch spring; NN, are a series of wires which are inserted crosswise into the links of the chains, MM, at a distance of about three-quarters of an inch apart, and riveted thereto. PP, are wire chains of the same length as the side chains, MM, but

formed of single links, which are connected lengthwise to the middle of the cross wires, in order to prevent the latter from bending or springing, and to keep them at their assigned distances from each other. The links *a* and *b*, of the main chains, MM, are three inches and three-eighths of an inch long, by five-eighths of an inch in breadth ; the double ones, *b*, are a quarter of an inch, and the

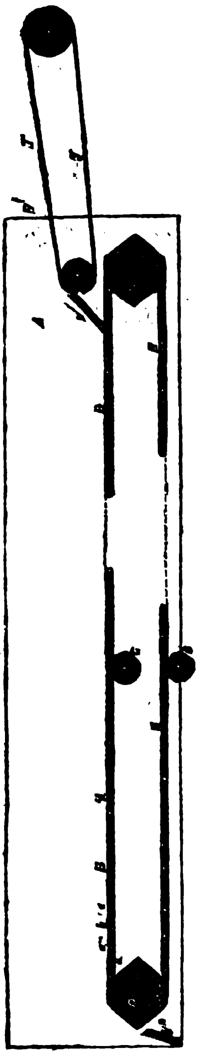


Fig. 4.

Fig. 8.

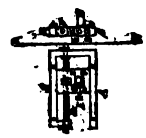


Fig. 9.

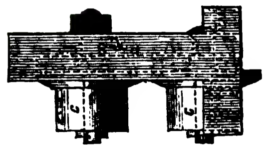


Fig. 7.

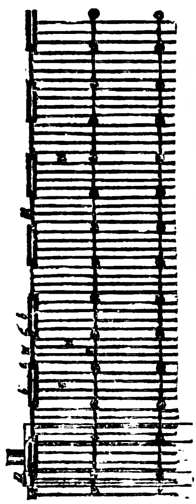


Fig. 5.

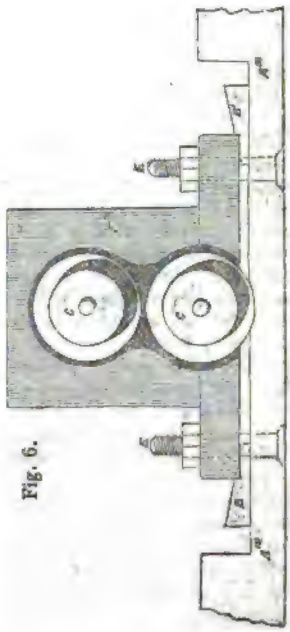


Fig. 6.

single ones, *a*, three-sixteenths of an inch in thickness. The cross wires, NN, are made alternately of round wire of an eighth of an inch diameter, and of flat wire of an eighth of an inch in breadth, by a quarter of an inch in thickness.

The patentee finds that a revolving bottom made of chains and wires of the

above specified dimensions, and connected together in the manner described, is amply sufficient to carry biscuits, or any other articles of like weight, and will maintain an even surface, and run true for a great length of time.

But where the articles required to be baked are of a heavier description, such as loaves, cakes, &c., it is proposed to substitute an endless chain of solid iron plates, hinged together.

The side rollers which bear up the revolving bottom are mounted in frames secured to the floor of the oven; as represented in fig. 6, (a side view of these frames,) fig. 7, (an end elevation,) and fig. 8, (a plan); A^a, is a basement plate, which is sunk into a recess made in the floor F of the oven, close by the side wall, G. F^2 is a pedestal raised on the basement A^a. CC, represents a set of rollers, one placed above the other, which have their bearings in the pedestal, and turn freely on their axes. The rollers are flanged, in order to keep the revolving bottom from swerving as it passes over them, and the flanges are sunk in the faces of the frames to prevent the chains from getting entangled by them. B^1 B^1, are wedges used to raise the rollers as may be required.

The large driving rollers, DD, are made six-sided, and each side of a breadth corresponding with the length of the links *a*, *b* and P of the endless bottom. No studs or spurs are used to take hold and carry round the endless bottom, the strain of the flat links on the hexagonal sides being found quite sufficient for the purpose. Driving rollers of a circular or other plain form, with studs or spurs, may however be used, if preferred. The rollers (of whatever shape) are placed inside the ovens, and their axles carried out at one end through the side walls, as shown in the front elevation, fig. 1; the pulleys by which they are worked from the steam engine being attached to these outward prolongations of the axles. The working of the ovens being thus effected with closed doors, there is as little loss of heat, as may be, attending the operation.

In order that the revolving bottom may be tightened or slackened as may be required, the axles of the driving rollers, DD, are secured on slides moved by screws in the manner represented in fig. 9. A is a slide frame attached to the door frame of the oven; B, a slide; C, the axle of one of the rollers; D, a clutch plate to fasten the axle with; E, a screw pin; F, a nut, by which the screw G is worked, which moves the slide B; H is the line of the oven wall.

A longitudinal section of one of the ovens, showing how the articles are delivered into it, and how discharged, is given in fig. 4. A is the oven; R^1, front door; R^3, back door; B, the endless bottom, which revolves round the rollers, DD, and is borne by the side rollers, CC. T is the endless cloth of the cutting machine, from which the biscuits or other articles are delivered on to an inclined plane of polished iron, V^1, from which they pass forward to the revolving bottom, B; V^{11} is another inclined plane (similar to V^1) which receives the articles as they are turned from off the revolving bottom at the back of the ovens, and conducts them forward to a basket, or other suitable receptacle.

Instead of employing an endless revolving bottom, and causing the biscuit or other articles to go in at one end of the oven and go out at the other, a reciprocating bottom may be used, and the articles turned out at the same end at which they are introduced (one door being thereby dispensed with.) In that case, the reciprocating motion may be best obtained by means of a vertical rack working in pinions on the outward prolongations of the shafts of the hexagonal driving rollers, DD.

The driving rollers may be also worked by continuous wheel-gearing or other machinery (instead of either of the modes before pointed out), providing always that such gearing is in correspondence with the motion of the cutting machinery.

The continuous rotary motion may be stated as being generally preferable, wherever the biscuits or other articles to be baked are supplied to the ovens by machinery, and the intermittent motion as answering best where the ovens are filled and emptied by hand.

The bottoms, BB (whether revolving or reciprocating), may be also extended beyond the front and back doors of the ovens, and the driving rollers, DD, be also placed outside; and, indeed, in all cases where the articles to be baked are of such a description that they can only be conveniently introduced, and taken

out, by hand into the ovens, this will be found the most suitable arrangement. Great care, however, must be taken to make the doors fit as close down as may be upon the (revolving or reciprocating) bottoms.

Fig. 12.

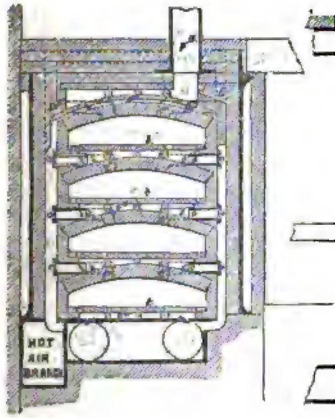


Fig. 11.

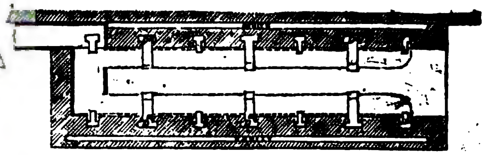
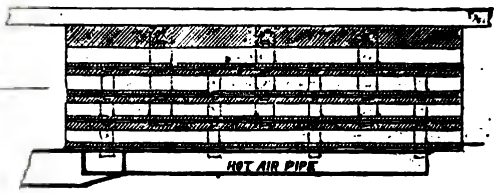


Fig. 10.



In working on either principle a set of four ovens, such as represented in figs. 1, 2, and 3, and of 26½ feet in length by 4½ feet in breadth, which gives an area equal to the placement of about 1½ cwt. of hexagonal biscuit, the motive parts of the machinery are stopped as soon as the ovens are filled, which occupies about a couple of minutes. The doors are then closed for about twenty-six minutes; after which the doors are reopened, and the motive power is applied at such a speed to the revolving bottom that it shall deliver in about two minutes more the entire quantities with which the ovens have been charged. I would prefer, however, to have the ovens longer, and the bottom revolving continuously at such an adjusted speed that the biscuits should be completely baked while passing through from the front to the back of the oven.

But in that case the driving rollers must of necessity be placed outside of the oven doors, and these doors must have apertures in them just sufficient to allow the revolving bottom and biscuits to pass through, accompanied with as little cold air as may be.

The heating of the oven is effected by the improved arrangements represented in figs. 10, 11 and 12 of the accompanying engravings. Fig. 10 is a sectional elevation; fig. 11, a ground plan; and fig. 12, a transverse section of a set of four ovens (similar to that before described), showing the details of this part of the invention. Mr. Harrison discards the direct application of fire to the ovens, and makes use of hot air only. The hot air is admitted as equably as may be by inlet pipes, $A^a A^a$, into an air-chamber, B^a, which extends the whole way under the floor of each oven; and each floor is made of perforated tiles, *t t*, laid on bricks, *x x*, so placed as to allow the hot air to ascend freely between them. Apertures, C^aC^a, of suitable dimensions are made in the top of each oven for the escape of the used air, whence it flows into an up-shaft, D^a, which is carried up alongside of the series of ovens, and is common to the whole. The up-shaft terminates in a receiving chamber, E^a, which extends the whole way along the top of the uppermost oven, and from this chamber the hot air passes off finally into the atmosphere through the chimney, F^a. Both the inlet and outlet passages have valves attached to them, which are worked by connecting-rods from the front of the ovens, whereby complete control is obtained over the quantities of air both admitted and discharged.

ON THE METHOD OF SETTING OUT RAILWAY CURVES.

Sir,—The methods of setting out railway curves which are now to be met with in works on railway surveying, and scientific periodicals, are very numerous, and many of them are ingenious and theoretically excellent—but it has appeared to me that they all want a very important quality, viz., simplicity; and that whilst their correctness was established by pages of mathematical formulæ, readiness of application in the field was lost sight of.

With this persuasion, I venture to lay before such of your readers as may have to set out curves (either before or after the formation of a railway), a few simple modes, applicable to a variety of circumstances of setting out. I do not claim for them any novelty of principle, *practicability* being my chief aim. Having tried most of the methods myself, in different cases, I am enabled to speak with confidence of the readiness and ease with which they may be adopted in the field, whereas I may appeal to most practical men to confirm the impossibility of easily putting many of the methods before alluded to, into practice. Should some of the modes recommended, and the explanation of them, appear very elementary to some of your readers to whom these matters are familiar, I must beg them to bear in mind, that there is a class of practical men extensively employed, both by railway companies and contractors, whose previous education has not been of a kind, likely to bring such subjects under their notice.

There is, I fear, not unfrequently a good deal of what is called "fudging in," in setting out curves, by which they look tolerably well on the ground, but from want of accuracy in the junction with the straight lines, there is sad trouble occasioned when they have to be set out for the permanent way and rails. I have also known persons who considered themselves experienced surveyors, who spent many times as long over a curve as they need have done, from neglecting to adopt some ready, yet certain method of ascertaining the exact points at which the curve should start and end; commencing at the *supposed* beginning of the curve, and after trying it round and finding that it does not come in, starting a little further back or forwards on the straight line—and perhaps repeating this tedious operation three or four times, until by some lucky approximation it comes in tolerably near. I would ask these individuals, how long they would expect to be in setting out a curve of half, or three-quarters of a mile in length, the radius of which had been lost or altered, and an occasional bridge erected binding them to an inch or two, in different portions of the curve's length? I hope, however, to convince them, that with proper management, it is perfectly needless to go over a curve more than once, that if they possess a theodolite, and a table of logarithms, of numbers, sines, &c., (Chambers's 3s. 6d. work of Mathematical Tables is an excellent one for the purpose), every particular required may be ascertained on the ground, in a few minutes. Most of your readers are aware of the ease with which operations in figures are made, with the aid of logarithms; and in the cases to which I shall allude, and of which examples will be given, there is little more required, than a reference to two tables and one or two little multiplication sums, which may be easily made on the ground—whereas, in one of the plans to which I have before alluded, it is stated, that "*a few hours* spent in calculations at home will greatly facilitate the operation of setting out the curve on the ground."

I shall divide the subject into three portions—the first relating to cases where the radius of the curve is known, or determined on—the second, to cases where the radius of the curve is *not* known, but has to be decided on, or reproduced, from some of various data—and the third part giving some rules for setting out curves with the theodolite, ranging rods and tangential offsets, and remarks thereon:

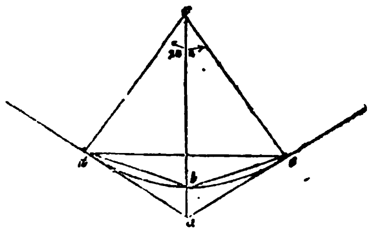
1*st.* *Where the Radius of the Curve is known.*

To ascertain the *exact length* of a curve of a given radius by three methods.

Let *dbe* be a curve of a 100 chains radius, the exact length of which is required.

1*st Method.* Produce the straight lines which it is intended to connect, until they intersect at *a*. Place a theodolite at *a*, and find the angle *dae*. Let it be,

Fig. 1.



for example, 160°. The angle at the centre, *dce*, is therefore 180° − 160°, or 20°, and the length of the arc *dbe* of 20°, is found by the simple calculation, that as 360° : 20°, so is the circumference of a circle of 100 chains radius (628·32 chains) to the arc or curve *dbe*— = 34·907 chains *f;* or 34 chains 91 links.

2nd. Method. The angle *dae* (made by the production of the tangent lines), subtracted from 180°, gives the sum of the two angles *ade*, *aed*, and these angles being obviously equal, each is 10° in the example given. Bring this number of degrees into minutes, divide by the number 1719 (more accurately 1718·87) and multiply the quotient by the radius of the curve in chains. The result is, the length of the curve in chains. Thus 10° = 600′ divided by 1719 = ·34907, and this multiplied by the radius 100, gives 34·907, or 34 chains 91 links, for the length of the curve. The length of a curve of 60 chains radius, connecting the same lines, would be ·34907 × 60 = 20 chains 94½ links, the angles being the same, whatever the radius of the curve.

3rd Method. Look in a table of the lengths of circular arcs (see p. 311 of Chambers's Work), you will there find that the length of an arc of 20 degrees is ·3490659 of the radius. Multiply this by the radius, and the result is the length of the curve—·3490659 × 100 = 34 chains 91 links nearly.

To find the starting points of a Curve of a given Radius, by two Methods

1st Method. By ascertaining and measuring the distance on the straight lines produced, from the point of intersection to the starting points.

Look in the table of logarithms for the logarithm of the tangent of half the angle at the centre, (that is the angle *ace*, in the example 10°, logarithm 9·2463188). Subtract 10 from the logarithmic tangent to obtain the natural tangent (1·2463188), and the number of which this is, the logarithm is found at once, on reference to the table of logarithms of numbers, to be ·17633. The tangents *ad*, *ae*, are therefore ·17633 of the radius. Multiply this by the radius, and their length is found to be 17 chains 63 links when the radius is 100 chains; and of course, for any radius whatever, supposing the lines at the same angle, the same proportion of ·17633 to 1 will exist. By chaining the ascertained length along the straight lines from *a*, both starting points may be determined to a link.

2nd Method.—By angles, the centre of the curve being also ascertained.

Find in the table of logarithmic secants the secant of half the angle at the centre—say 10°, as before, logarithm 10·0066485; logarithm of natural secant, therefore, ·0066485 ; number corresponding to this logarithm, 1·01543. The secant, *ca*, is therefore ·01543 of the length of the radius in excess of it; and by multiplying this decimal by the radius, 100 chains, the distance, *ab*, will be 154·3 links. By setting off half of the angle at the point of intersection (*i. e.*, say one-half of 160°) from either straight line, the *direction* of the point, *b*, is of course very readily found, and this point, *b*, itself ascertained by measuring out from *a* the number of links above given.

Then placing the theodolite over the point, *b*, set off 90° from the point, *a*, *plus* one-fourth of the angle at the centre, that is, 95° in the example; and where this angle cuts the straight lines, are the starting points of the curve at either end. Thus, *abd*, *abe*, fig. 1, are each angles of 95°, and *d* and *e* the points where they cut the straight lines. The angle, *dbe*, is always greater than the angle, *dae*, by the one-half of the angle at the centre. It is, therefore, 160° + 10°, or 170°, in the case given; and it is well known that the angle, *dbe*, would still be 170°, were the point, *b*, placed at any portion of the curve, *dbe*. One of the plans for setting out curves, to which I alluded in the commencement of this paper, is based on this principle. The writer asks you, first to determine the points, *d* and *e*, by methods which he does not describe, and then to set out the curve by making the angle, *dbe*,

always the same. Even supposing you can see the points, *d* and *e*, from each other, which is *very often* not the case, the *extreme* tediousness of placing the instrument to read the same angle at 20 or 30 points of the curve, is quite lost sight of. I mention this as a specimen of one of the *unpractical* methods of staking out curves to be found in books.

When the length of the curve does not exceed 20 or 30 chains, it will often be found the readiest way of setting out, to place the theodolite at *b*, and to chain from *b* towards *d* and *e*, first obtaining the tangent to the curve at that point by setting off 90° from *ba*, or, what is better, (the distance being usually much greater) by setting off from either of the starting points, *d* or *e*, *one-fourth of the angle at the centre*. Then at 1 chain from *b*, in either direction, the angle from the tangent is 1719 minutes divided by the radius in chains. For 2 chains, twice that angle, and so on. Thus for a curve of 100 chains radius, the angle from the tangent at 4 chains from *b* is $1719 \times 4 \div 100 = 1° \cdot 8\frac{3}{4}'$, and that for 17 chains, 45½ links from *b* is 5°, which is one-fourth of the angle at the centre.

Should it be required to determine the place of one end of the curve from the other end by an angle, it is readily done by setting off from the straight line at *d* or *e* an angle equal to half the angle at the centre. In the foregoing example, the angle, *ade*, or *aed*, is 10°. This, like all the other cases of finding starting points, &c., by angles, is quite independent of the *radius* of the curve, and applies to *all curves between the same straight lines.*

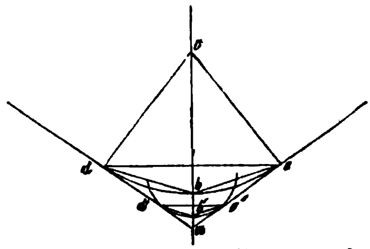
2nd Portion.—Cases where the Radius of the Curve is not known, but has to be ascertained from various data.

Before the Formation of the Line of Railway.

Produce the straight lines until they intersect, and obtain their angle at the point of intersection (an operation which should be the first in every case where practicable): then if any circumstance (such as the occurrence of buildings or other property) make it desirable that this curve should start at any given point, *d*, on the straight line, the distance, *da*, is to be measured; and being the tangent of the angle, *dca* (half the difference between the angle at *a* and 180°), the radius may be found by reference to the table of logarithms, as before. Thus, if the distance, *da*, be 17 chains 63 links, and the angle, *dca*, 10°, the line, *da*, would be to the radius as ·1763 : 1. The radius therefore is 100 chains.

If it be necessary that the curve should pass through some point, *b*, at *the centre of its length* (its starting points being immaterial), then measure the distance, *ab*, and look in the table of logarithms for the secant of the angle, *dca*. Let *dca* be 10°, and the measured distance, *ab*, 154·3 links. Then (as in a foregoing case), as ·01543 is to 1, so is 154·3 links to the radius – =100 chains.

Fig. 2.

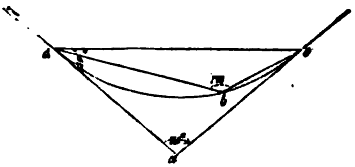


If it should be expedient to reduce the distance from the point of intersection, making it b^1, instead of *b* (fig. 2), then the radius of the curve, the length of the curve, and the length of the tangent, *ad*, will be reduced *in the same proportion*. Thus, if the distance, ab^1, were fixed at 77¼ links, instead of 154·3 links, the radius would be 50 chains, and line ad^1, 8 chains 81½ links, and the length of the curve would be 17 chains 45½ links. This arises from the fact alluded to before in the method of ascertaining the starting points of the curve by angles, that the angles, *abd*, ab^1d^1, are the same, whatever the radius of the curve. The chord lines, *db*, d^1b^1, are therefore parallel, and form the bases of proportional triangles.

Suppose, however, that instead of the point, *b* (through which it is necessary that the curve should pass) being in the line, *bc*, it should fall in some other part, as in fig. 3.

Let the angle, *dae*, be 160°; then ascertain *approximately* from the survey, if one has been made, the length of the lines, *ad* or *ae*. Measure this length off, and placing the theodolite, say at *d*, make *ade* an angle of 10°. Suppose, for ex-

Fig. 3.



ample, that *ad* has been taken as 17 chains 80 links, *ae* will be thus made the same length. Remove the theodolite to *b*, and ascertain if the angle; *dbe*, is 170°. Should it be on trial only 169½°, let the poles at *d* and *e* be shifted any *equal* number of links each time, until the angle, *dbe*, is *exactly* 170°. Should *ad* (or *ae*) be then 17 chains 63 links, the radius will prove to be 100 chains, by the method before given—which is the radius of the *only curve* which will connect the two straight lines, and at the same time pass through the point, *b*. This is an important case, which may not unfrequently occur, and the above method (depending on the well-known fact of the angle, *dbe*, being always the same, let *b* be at any part of the curve), is one that will occupy but a short time on the ground, whilst it will afford the usual data for ascertaining all the required particulars prior to setting out the curve.

Cases where the curve has to be set out "after" the formation of the railway:

It will frequently happen that the original radius of a curve may not be known, or that, in the prosecution of the works, the direction of the straight lines or of the curves may have been departed from —making it necessary to re-set out the curve, to suit some cutting or other portion of formed railway.

In these instances, the best mode appears to be to prolong the straight lines and take their angle, as usual. Then, to measure the distance from the point of intersection to the centre of the cutting or ballast, viz., the distance *ab*, the line *ab* being set out in a proper direction by the method before described. Next, ascertain the secant of half of the angle at the centre, and obtain the radius by the proportion which the distance *ab*, bears to *d*, as in the case previously given. Example: The angle of two straight lines produced is 160°. The angle at centre is therefore 20° and one half of it, 10°, the secant of which angle is 1·01543 of the radius; and if by measurement from the point of intersection to the centre of the cutting, or ballast, &c., the distance *ab* is 154·3 links, this distance is to the radius as ·01543 is to 1, and the radius is therefore 100 chains. For as ·01543 : 1 :: 154·3 links : 100 chains.

If the direction of the original straight lines has been adhered to, and the starting points of the curves have remained accurately pegged out, the reverse of either of the three methods given for finding the length of a curve may be used to ascertain the radius; viz.,—

As the angle at the centre is to 360°, so is the length of the curve as measured or noted down, to the circumference of the circle, the radius of which is easily found. Or, the number of minutes in *one-half* of the angle at the centre being divided by the length of the curve in chains, the result is the angle in minutes between each chain; and the number 1719 being divided by this number of minutes, the quotient is the radius of the curve. Example: Angle at the centre 20°; half of ditto, 10° or 600′. Length of curve 34 chains 91 links—600′÷34·91=17′·19, the number of minutes offset for each chain, and 1719 divided by 17·19 gives 100 chains as the radius.

The third method is the reverse of that obtained by reference to the Table of Arcs. Example: Arc of 20° is to radius as 34906 is to 1. Therefore as ·34906 : 1 :: 34 ch. 91 links to 100 chains the required radius.

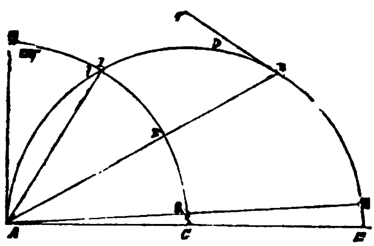
The radius of the curve being obtained in either of these ways, the curve may be set out by one of the given methods. The safest plan is, however, to obtain the radius of the curve from a measurement of the distance, *ab*, and the secant calculation. The *centre of the curve* will thus be ensured correct, and the ends are of far less importance.

Another simple approximate method of finding the radius of a curve is the following:—Measure a few chains along the curve, commencing at *any* point of it, and driving a peg at each chain end, at the exact centre of the width of the ballast or cutting. Place the theodolite over the first peg, and take the angles in minutes between the second and

third, the third and fourth, and so on. If the number of minutes should be equal, say, for example, 17·19 between each consecutive peg, the radius will be 1719÷17·19 or 100 chains. But if the angles vary to any extent, the line cannot have been formed to a regular curve, and it must be either altered, or if the variations are great, more than one curve should be set out by one of the methods described; the tangent lines being produced to intersection at each change of curvature, and the method of secants being adopted as being the most certain.

I now come to the last division of the subject, viz., the rules for setting out curves with the theodolite, ranging-rods, and tangential offsets.

When the starting points of a curve are determined, either of the three above-named modes may be adopted. That with the theodolite is unquestionably the preferable mode. The rule has been before alluded to; it is to divide the number 1718·87 by the radius; in chains, distances of 100 feet, or any other interval at which it is intended to determine points in the curve. The result is the angle in minutes between each consecutive distance of a chain, or 100 feet, as the case may be. The number 1718·87 is obtained by dividing the number of minutes in a *quadrant*, by 3·1416, the proportion of a semicircle to its radius



In the annexed diagram, ADE is the curve required to be set out from its starting point, A, the radius, AB (or CD) being 1 yard, chain, or other fixed distance. The quadrant, BC, is that from the division of which the semicircle is set out, since a line from A passing through any point on the circumference of the quadrant will obviously cut off twice as great an arc of the semicircle, ADE. Now the semicircle contains 3·1416 lengths equal to the radius, AB, and by dividing the quadrant, BC, of 5400′ into 3·1416 parts, each part contains 1718′.87, and the distances A1, 1, 2, and 2, 3, on the semicircle, will be equal to the radius, or 1 yard, or 1 chain each. If the radius, AB, were 100 chains, the arcs B1, 12, 23, of the quadrant would be 17′.19 each, and the length of the curve, ADE, would be 314·16 chains. The product of these numbers would still be the 5400 minutes in the quadrant, BC. In practice this quadrant, BC, is of course the plate of the theodolite, which is exaggerated in the diagram for the convenience of showing the relation of the lengths of the different lines. This method of setting out is perfectly accurate for any number of chains, and a complete circle could be set out without removing the instrument from A. In a long curve, where it becomes necessary to shift the theodolite two or three times, very great care is requisite to set out the new tangent correctly. If, for example, the angle BA2 be 57° 18′, and it become necessary to shift the instrument from A to 2, the tangent 2 T is readily found by making the line 2 T at an angle of 57° 18′ with the line 2 A. The method of setting out by the theodolite has also another advantage, viz., an error in fixing an intermediate point in the curve is not continued over the remainder, unless it be at a changing point, as just described.

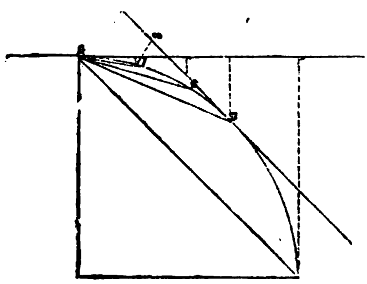
The rule for ranging out a curve with rods (or at least one of the many rules), is the following:—Divide the number of inches in a chain by the radius in chains, and the result will be the offset in inches of each chain peg from a straight line through the two adjoining pegs. For the first chain peg from the starting point, the offset will be one-half this distance from the tangent line; this method is a very accurate one theoretically. In practice, however, it is liable to serious errors, as will be seen from the following diagram.

If an error of an inch be made in the

position of the peg 1, the dotted line being produced through 1′, instead of the correct straight line, that error will be doubled at 2′, tripled at 3, and so on. In a long curve the final error would in such a case be very important. The only set off against this liability to a multiplication of an error is the probability that an error of an equal amount will be made in an opposite direction. It would seem a better plan to range through a length of two chains instead of one, that is from 0 through 2, from 1 through 3, and so on; the offset in that case is half as much again as by the usual method. By setting out one chain from a line two chains long, any error would be increased by one half, instead of being doubled.

A curve may be set out with rapidity by this and similar methods, which space will not permit my alluding to. If the starting and centre points of the curve are determined by one of the methods described, any error would be soon detected; but if this is not the case, many tedious trials may be needed before the curve can be brought in with accuracy.

Setting out curves by offsets from the tangent lines is a preferable mode to that of ranging, since an error in one chain, does not affect the position of the succeeding points of the curve. The rule in this case is simple, and far more accurate than is generally supposed. Divide the number 396 by the radius of the curve in chains, and the result is the tangential offset in inches, at the end of the first chain. Square the number of chains, or chains and parts, where it is required to set off an offset, and multiply by the number of inches offset for 1 chain, to obtain the offset required; thus, the offset from the tangent line at 1 chain from the starting point, if a curve of 33 chains radius, is 12 inches, at 2 chains it is $2^2 \times 12$ inches or 4 feet, and so on.

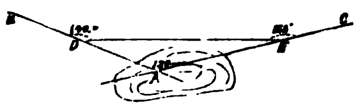


This plan of setting out, is not applicable to curves of a small radius. The flatter the curve, the less is the error, and the offsets are also much shorter. Thus, in a curve of 66 chains radius, the offset at 1 chain is 6 inches, at 6 chains it is 18 feet; the error in this case would be but about one-eighth of an inch: whereas, if 8 chains were set out, the offset would become 32 feet, and the error three times as great, or nearly half an inch; the error increases in about the ratio of the biquadrate of the number of chains. It will be observed that it is but trifling, in the instance before given, the cause of the error is shown in the diagram. It arises from the *arcs* 0 1, 0 1 2, &c., being squared, instead of the *chords* 0 1, 0 2, 0 3. In a quadrant, of the radius 1, the difference is that which exists between the square of the chord 1·4142 (or 2), and the square of the arc 1·5708, which is 2·467. In a whole quadrant, the error of the method of squaring the number of chains of the curve's length, would be enormous, amounting to nearly one-fourth of the radius. The rate of diminution of the error is however very rapid. At half the quadrant it is about $\frac{1}{16}$th of that for the whole quadrant, decreasing about $\frac{1}{256}$ for one-fourth of the quadrant. I have found the following, convenient approximate rules, for ascertaining in a few moments, how many chains of a curve of a given radius could be set out in this manner without an error worth consideration. 1st. Multiply the number of chains in the quadrant by 10, and you have the number of feet error, if the quadrant were set out on this plan. Thus for a curve of 100 chains radius, of which the quadrant is 157 chains, the error would be about 1570 feet. At one-half the quadrant, it would be about the biquadratic of one-half, or about one-sixteenth of this error, viz., about 100 feet; and thus a rule for obtaining approximately the error at half the quadrant, viz., the error at one-half the quadrant is as many feet as the radius is chains. It is easy to obtain from this last rule the amount of error which would exist at 10 chains; for take one-half the quadrant length as 80 chains; then 10 chains equals one-eighth of this, and one-eighth biquadrated equals about one-four thousandth. The error at 10 chains is thus found sufficiently near to be one-four thousandth of 100 feet, or one-

fortieth of a foot, or about five-sixteenths of an inch. In a curve of 200 chains radius, 20 chains could be set out with an error of about one-third of an inch only. The offsets must all be measured from the end of the successive chains in the *curve*, and not on the *tangent* line, and they must be set off accurately at right angles to the tangent line. When it becomes necessary to have another tangent, it is readily obtained by setting off at 4 or 5 chains back from the last fixed point, the offset due to that number of chains, as the line 3 *a* in the diagram, the offset 1 *a* being that for two chains. In a flat curve it is only necessary to change at an even number of chains, and to set up a rod on the original or last tangent line at one-half this number of chains from the starting point. The line between such rod and the last peg will be the direction of the new tangent.

Cases will occasionally occur in which one end of a curve is inaccessible, from its being in a river, &c. If the straight lines are determined, there will be no difficulty in setting out the curve from the centre or the other end of it up to the point where the obstruction commences. The distance at which the curve ends from the edge of the water, will be known by measurement from it to the point of intersection.

If the point of intersection occur in a piece of water or other situation in which a theodolite cannot be placed to take the angle, it may be obtained in the way shown in the following diagram.



Fix on any points, D and E, on the respective straight lines produced, and placing the instrument at D, obtain the angle, BDE (say 140°.) In like manner find the angle, CED (say 160°.) The sum of these angles (300°) subtracted from 360°, leaves 60° for the two interior angles, ADE, AED. Therefore the angle at A equals 180°—60°, or 120°.

In conclusion, I must apologize to your readers and yourself for occupying so large a space on this subject. I have endeavoured to give, in some sort of order, a few of the methods which I have found useful; but I am well aware that they are not a tithe of those which might be enumerated, and, I, for my part, shall feel indebted to any of your readers who may look over my paper, if they will send to your columns a description of methods which they are in the habit of using, and which they may consider equal, or superior, to those I have named. But I trust they will be proved and practicable plans, and not such as they have tried on paper only. It is a great advantage to be in possession of a number of ways of doing the same thing, in order to be able to adopt that one which may be best suited to the particular circumstances of the case.

If some of your readers think that it is better to consult a set of tables, of which there are several published, instead of working out the calculations by logarithms, I would beg to remind them that these tables possess two or three great drawbacks. They are generally expensive, often bulky, and they are only of partial, whilst logarithms are of universal application. But above all, they usually omit the most essential information of all, viz., the length and the exact points of commencement and termination of the curve. Tables of logarithms are to be met with in a very cheap and portable form, and the calculations required in setting out curves are among the most simple of the applications of logarithms.

With the hope that the foregoing rules may be useful to some of your readers,

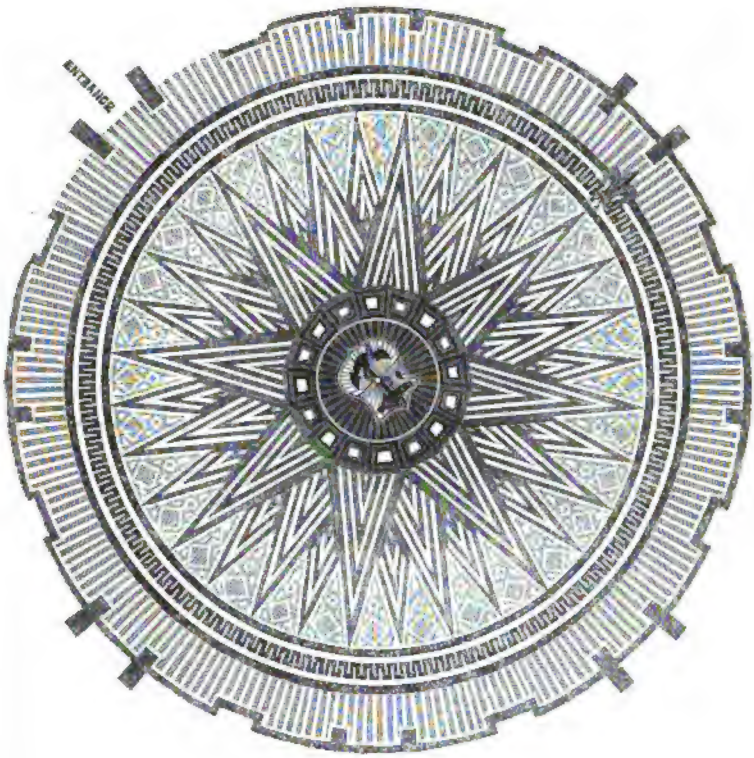
I am, Sir, yours, &c.,

F. F.

Cardiff, Oct. 9, 1849.

THE TESSELLATED FLOOR OF THE NEW COAL EXCHANGE, LONDON.

The New Coal Exchange, which has been opened with so much *éclat* during the present week, is remarkable for nothing so much, to a mechanical eye, as the tessellated floor of the Grand Hall (60 ft. in diameter), of which the opposite engraving is a correct representation. It consists of upwards of 4000 distinct pieces of wood, of various kinds and qualities, which are arranged in the form of the mariner's compass, having the City shield, anchor, and other ornamental devices in the centre. The great feature of the affair is, that the whole of these pieces were, only a few months since,



either in the tree in the growing state, or cut from wet logs, and prepared for use in the course of a few days, by the new method of seasoning, known as the Patent Desiccating Process of Messrs. Davison and Symington. The woods employed are black ebony, black oak, common and red English oak, wainscot, white holly, mahogany, American elm, red and white walnut (French and English), and Mulberry. The black oak is part of an old tree which was discovered, and removed from the bed of the Tyne about the latter end of last year. This tree is supposed to have grown on the spot where it was found, and, owing to its large dimensions, must have been at least 400 or 500 years old at the time it fell, but how many centuries it has been covered with water it would be impossible to say. A considerable portion of this tree was, at the request of Mr. Robert Davison, C.E., (to whom the execution of the floor was entrusted,) very kindly forwarded to London, by the Mayor and Corporation of Newcastle. Of course, it was completely saturated with moisture on its arrival, but it now forms a beautiful contrast to the other woods, owing to its exceedingly dark colour. The red and white (or sap and heart) walnut, on the other hand, was growing in the very ancient park belonging to C. T. Towers, Esq., Weald Hall, Essex, in December last; this tree now forms the circular fret—the red and white being alternately interspersed, has an excellent effect. The mulberry wood, introduced as the blade of the dagger in the City shield, is no less than a piece of a tree which was planted by Peter the Great, when working in this country as a shipwright.

Not one piece out of the 4000 occu-

pied more than ten or twelve days in seasoning; a conclusive proof that it is no longer necessary to keep wood for years to season, as has hitherto been the case. Besides the ornamental floor, and the floor to which it is secured, the whole of the timbers, joists, and woodwork of every description throughout the building have been desiccated by the patent process, the adoption of which by the architect, Mr. Bunning, does great credit to his judgment and discernment.

ON THE INTRODUCTION OF THE DIFFERENTIAL NOTATION INTO ENGLISH MATHEMATICAL PERIODICALS.

Sir,— In the last Number of this Journal, the able and talented reviewer of Sir John Herschell's "Outlines of Astronomy" has offered some remarks on the introduction of the differential notation into the mathematical periodicals of this country, which have led me to examine this subject more particularly than I had previously done. The result has convinced me that several of the reviewer's statements are slightly inaccurate, occasioned probably by a too hasty reference during the composition of his paper; and knowing how difficult it is to restore to the rightful owners what has been unwittingly misappropriated to others under the sanction of high authority, I have been induced to trouble you with this note, and hope to secure the kind indulgence of the reviewer, notwithstanding the freedom of the following remarks:—

1. To what is stated respecting the adoption of the differential notation by Ivory and Wallace, it may be added, that Mr. Ivory used differentials in his solutions to Questions 151 and 160, vol. ii., *Mathematical Repository;* and both Ivory and Wallace in their solutions to Ques. 172. *This must have been previous to* 1807, *for the* 1*st of May in that year was the time allowed for the arrival of solutions up to Ques.* 210, *and vol. ii. of the Repository was completed early in* 1809. Such being the case, it would seem that the *Mathematical Repository* was the *first* periodical in which the differential notation was partially adopted.

2. Mr. George Harvey, jun., of Plymouth, published a paper in the *Gentleman's Mathematical Companion* for 1815, "On the Reduction of Infinite Series to Differential Equations of all Orders;" it was translated from *Bossut's Calcul Differentiel;* and the differential notation is retained, but it did not appear in a solution until "A. B. L." used it on Ques. 476 in the *Companion* for 1820.

3. Mr. Thomas White, of Dumfries Academy, appears to have been the *first* to introduce the notation into the *Gentleman's Diary*, for he uses it in the enunciation and solution of Ques. 1058 (from Laplace), in the *Diary* for 1816-17; it is also adopted by Mr. Glendenning (from *Dr. Gregory's Trigonometry*, 1816,) in his solution to Ques. 1117 in the same *Diary*, which contains Mr. Slee's answer to the prize question as noticed in the review.

4. Mr. Marrat, of Liverpool, introduced the notation in the *Leeds Correspondent* in the proposal of Ques. 278, No. I., vol. v., October, 1822, to January, 1823, and Mr. Macauley adhered to it in his own solution on page 80 of the same number.

5. Professor Thomson, of Belfast, has a *prior* claim to its introduction into the *Ladies' Diary*, since he uses it in the solution to Ques. 14 (1417) in the *Diary* for 1824.

6. Mr. Samuel Jones, of Liverpool, in a paper on "Maclaurin and Taylor's Theorems" adopted differentials; this paper was written in 1822, but was not published until the appearance of *Swale's Apollonius*, No. II., January, 1825. At the same time appeared the first number of *Clay's Scientific Receptacle*, in which the notation is extensively used by Messrs. Rutherford, Baines, and Gill.

From this period, to reverse a remark made by the late Dr. Gregory, the *de*-ists began to make strong head against the *dot*-ards, and, in the course of a few years, the fluxional notations almost entirely disappeared from the pages of our mathematical publications.

I am, Sir, yours, &c.,

THOMAS WILKINSON.

Burnley, Lancashire, October 24, 1849.

THE LATE FIRE AT LONDON WALL.

In No. 1268 of the *Mechanics' Magazine*, some account was given of Sir Samuel Bentham's fire-extinguishing works in Portsmouth and other dock-yards, as also of a plan of his which, in the year 1830, had been communicated to Sir Robert Peel, recommending analogous works for the better protection of the metropolis against conflagration. The public mind at that time was not ripe for such a measure, but the immense loss of property that has just occurred at London Wall may possibly rouse attention to the subject, and conduce to the introduction of means for preventing such a calamity in future.

Without any general adoption of his plan, parts of the works he devised for Portsmouth-yard, are applicable to private establishments, such as large cisterns of water on the roofs of buildings. Had there been a provision of this kind on the warehouses recently burnt down—cisterns contrived as were those he proposed to place on a mast store-tower at Portsmouth—on the outbreak of fire below, the whole body of water would have fallen on the burning mass, and would probably have quenched the fire before the most prompt application of any apparatus could have been had recourse to. From the account given in the *Times* of the fire at Messrs. Gooch and Cousins' warehouses, it appears that the wool was done up in covers which were highly inflammable, and rendered particularly so at the time from their dry state, and that the extraordinarily rapid spread of the flame arose from this circumstance; had water been let in immediately from cisterns above, even admitting that it might not at once have extinguished the fire, it could not but have wetted the coverings of the bales, and thus have prevented their sudden inflammation.

Messrs. Gooch and Cousins had no steam-engine, it would seem, on their premises; but doubtless permission might have been obtained from the Water Company serving the district to place upon their mains such fire-plugs as those in Portsmouth-yard, for screwing hose upon them; in that low part of the town the Company's head of water would have been sufficient to have thrown a stream over the building. Promptitude in the application of water constitutes a prominent feature in Sir Samuel's fire-extinguishing arrangements; and if the police, as he proposed, had had the means of throwing water from two or three such hose at the outbreak of the fire, it would, without doubt, have been damped, if not entirely extinguished, long before the fire-engines could have arrived at the spot, prompt as was their attendance.

Most of the poor inhabitants from No. 1 to 18 of Sadler's-place,—five or six families in a house,—have had their clothes and furniture destroyed; they were not insured. It is to be regretted that insurances for small sums should not be permitted, free of duty. This description of persons are more deterred from insuring their property by the tax than by the per centage of the Company—thinking it hard to pay twice as much to Government as is sufficient to insure them against all risk by fire. But although the wealthier proprietors of warehouses and of wool, will most of them be reimbursed, yet the destruction of property to the value of 100,000*l.* may be of serious commercial inconvenience; it is at least a substraction to that amount from the national wealth, and calls therefore for attention from the public as to the means of preventing such conflagrations in future.

It would seem, by an article in the *Times* of the 9th Oct., that the example first afforded in Portsmouth Dock-yard has been, in part, followed at the Chartered Gas Works with the best result. "The engines, as well as the *steam engine* of the Company, having been set to work, the fire was happily confined to that portion of the works where it first began." Wherever there is a steam engine, would it not be prudent to adapt it to the collateral purpose of extinguishing fire?

Some private manufacturers have, indeed, of late applied their steam engines, with suitable apparatus and other details of the fire-extinguishing works at Portsmouth, so as to promise protection against conflagration. *Chambers's Journal*, of Sept. 1st, relates that in the joiners' shop at the Thames Bank Building Works, there are self-supplying cisterns always full, with "a few buckets" "slung over each, ready for use in putting out fire." "Thus water, and the means of distributing it, are constantly on the spot."

This arrangement is good, but not equal to that of Sir Samuel's in the wood mills at Portsmouth. In the interior of the shops there, pipes, connected with a cistern of three tons of water on the roof, were laid from end to end of each shop, having taps upon them, from which suspended water-buckets might be filled; there were at different parts of the pipe nozzles prepared for affixing a hose; consequently such hose were instantly available for throwing water with force on any part of a fire; and that, although its situation or excessive heat might prevent the efficacious use of buckets. At the same works on Thames Bank, "should flame promote itself into a conflagration, it can be played upon without by hose applied to a pump in the yard, always available by steam power as a capstan;" an arrangement precisely the same as that of Sir Samuel's in Portsmouth-yard, and recommended by him for the metropolis.

These arrangements at the Thames Bank Building Works are said to afford "a lesson" to other manufacturers; but it is a lesson that has already been given to the public for nearly half a century in Portsmouth Dock-yard—not much later at Plymouth and Chatham, besides the subsequent fire-extinguishing works at Sheerness. Sir Samuel's steam-dredging machine, his caissoon gate, his steam engine moveable on wheels, and various others of his lessons, have produced good, extensive good, by their influence, and that so long ago that the origin of those improvements has been forgotten. Means of diminishing the ravages of fire would seem more generally interesting to the public than either steam-dredging or moveable steam engines, yet his fire-extinguishing arrangements have remained singularly long unimitated: their general importance, as tending to the preservation of property and of life itself, seem to justify a recurrence to the subject, and a repetition of statements that have already been before the public in the *Builder*, as well as in the *Mechanics' Magazine*. M. S. B.

PHILLIPS'S FIRE ANNIHILATOR.

Sir,—Numerous applications having been made to me for information respecting the so-called *Fire Annihilator* of Mr. Phillips, I attended last Friday at the London Gas Works, Vauxhall, to hear Mr. Phillips's explanation of his invention, and to witness his exhibition of its powers. The audience there assembled was both numerous and respectable, and it is much to be regretted that *better accommodation* had not been provided for them.

Mr. Phillips prefaced his experiments by a lecture of a somewhat remarkable character, the gist of which was evidently to prove that "flame" was the *vital part* of "fire," and that, "without flame fire has no vitality!"

The fallacy of this position would, however, be apparent to such of his hearers as ever saw an ordinary coke fire, without looking into the furnace of a locomotive, or a foundry. The object of this assertion was, however, subsequently apparent enough. Mr. Phillips then went on to show that flame was instantly extinguished when deprived of air, as it might be by submersion in water, or in spirits, injudiciously asserting that *spirits* were as effectual in extinguishing flame as *water;* a philosophic truth assuredly, but a most dangerous one to be thus unguardedly propounded to a miscellaneous audience. It is not many months since a person attempted to extinguish fire with spirits (taken in mistake for water), when the attempt cost him his life and involved the premises in destruction. Mr. Phillips then proceeded to show the inefficacy of water to extinguish fire, by the aid of some far-fetched and inopposite illustrations — among others, that of a burning mountain which the Mediterranean Sea was unable to extinguish.

Several miniature conflagrations were kindled in baby-houses, and model ships, and instantaneously extinguished by the application of an overwhelming proportion of gaseous vapour; forcibly reminding me of the remark of one of your correspondents, that "models of machinery are bad enough in all conscience for testing practical results, but the idea of a *model conflagration* is beyond everything preposterous."*

Mr. Phillips having worked upon the feelings of his hearers by a narration of several harrowing spectacles which he had witnessed (in his sleep?) of persons precipitating themselves from parapets, or falling backwards into the burning mass, concluded by stating, that this me-

* *Mech. Mag.*, vol xlii., p. 101.

tropolis would shortly be placed under the protection of a "Fire Militia," who would turn out on the first alarm of fire, and apply their *annihilators* with such promptitude as to extinguish the flames before the inmates of the burning house would be cognisant of their danger!

A fire was then kindled within a mimic house, destitute of either floors or staircase, the combustibles being merely a few timbers laid slantwise against the back wall, and prepared for burning with some inflammable liquids.

The flames raged fiercely for a few minutes, and to the unpractised eye presented the appearance of an awful conflagration. Just as the more inflammable matter had become expended, Mr. Phillips's man "Friday" walked into the burning building (and I accompanied him), and commenced discharging the gas, amidst the remaining flames, which were speedily extinguished; two vessels of gas having been expended. The timbers, however, which had been partly converted into charcoal, burned as brightly as ever, but without flame, and the aid of water was required (that inefficient agent!) to complete the extinction of the fire. Mr. Phillips's reason for describing *flame* as the *vital* part of fire was not apparent—his apparatus can only extinguish *flame;* while admitting this fact, he affected to treat it as of no importance, observing, that the fire-engines—the heavy artillery—would always come up to *finish the extinction of the fire!*

Upon the whole I was somewhat disappointed, as I had previously given Mr. Phillips credit for more candour, and his apparatus a character of greater usefulness than his lecture and exhibition warranted.

To all persons practically conversant with fire extinguishing, Mr. Phillips's experiment must be anything but satisfactory. Nevertheless, his invention is not wholly destitute of merit, or of utility, and would he but confine its application to legitimate uses, he may do much good, and derive suitable remuneration. In confined situations, such as the holds and cabins of ships, the rooms of dwelling-houses, and other similar places, Mr. Phillips's apparatus may be used with great probability of success. In a room provided with it, suppose the bed curtains to be set on fire, the inmates have only to discharge the apparatus and quit the room; the fire, being at first almost entirely composed of flaming surfaces, will be speedily extinguished. But here again comes the great drawback, that even the small amount of presence of mind required for discharging the apparatus, is too often wanting. The mental power at command is, in too many cases, inadequate to ensure the mere closing of the door—how can we then expect that use will be made of even the most simple apparatus?

The destruction of Raggett's Hotel, with its awfully-tragic accompaniments; as well as the deplorable losses of life in Ivy-lane, Spitalfields, King William-street, &c., might each have been prevented *by the closing of a door.*

Mr. Phillips's apparatus might easily be made self-acting, but that there is an insuperable difficulty in ensuring its action at a sufficiently early period of a fire—a difficulty which has proved fatal to all our *fire-alarms* (many of them exceedingly ingenious and well arranged).

Mr. Phillips's apparatus has the advantage of requiring no labour (as in pumping) to be performed at the moment of danger, and a still greater advantage, that it does not entail the necessity of the user remaining in the apartment to direct its application. In the latter respect it has an important advantage over the portable apparatus of Captain Manby;* with one of the Captain's portable antiphlogistic vessels, however, I would undertake to *extinguish entirely* (sparks and all) a body of fire three times as great as that upon which two of Mr. Phillips's vessels were discharged, on Friday last, extinguished the flame alone. Of 805 fires in the Metropolis, during 1848, no less than 577 were extinguished by the exercise of as much presence of mind as would be required to apply Mr. Phillips's apparatus, and the extinction of 228 only devolved on what he calls the "heavy artillery."

Prevention is better than cure—fires are much more easily avoided than extinguished, and we know that by the exercise of a small amount of carefulness, nearly one-half of last year's fires might have been prevented.

While the public are so reckless, therefore, it is almost hopeless to expect that any contrivance for *extinguishing* fire will be generally adopted by house-

* See *Mech. Mag.*, vol. iii., page 28; also vol. xxxiii., page 117.

keepers while the ordinary means of *prevention* find so little favour.

I remain, Sir, yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington, October 29, 1849.

ON THE MEANS OF REPAIRING WHARF-WALLS WHEN THEY SINK OR SLIDE OUT OF THEIR PLACES. FROM THE PAPERS OF THE LATE BRIG.-GEN. SIR SAMUEL BENTHAM.

In the year 1811, parts of the wharf-wall at the Victualling Premises at Deptford cracked and sank down in some places very considerably, when it was proposed to hold the wall in its place by tying it to the nearest storehouses, on which Sir Samuel Bentham gave it as his opinion, in 1812, that "had the wall only slid outwards, such means might prove effectual in resisting any tendency in the wall to slide out farther; but in the case in question, it was evident that the foundation of the wall was not, at the time of its construction, carried down to the firm ground, therefore the tying the wall as proposed would be, in effect, the *suspending* it by the storehouse—an expedient as dangerous as ineffectual." He continued thus:—

"The cause of failure of this wall is evidently the not having paid sufficient attention to the different degrees of firmness of the ground at the time of laying the foundation of the different parts of the wall." "The remedy therefore the most to be depended upon, and consequently the one which I must adopt, is now to force the wall *downwards* with a pressure that may be considered as sufficient to cause such parts as are built over the *less* firm ground to *sink* till they find a firm support, either by really coming to firmer ground or by compressing the yielding ground into a firmer state. For this purpose, the whole of the part of the wall that has given way should be *dis*connected from the storehouse, and should be *loaded* on the top so much as to double, *at the least*, the pressure of the wall itself on the foundation.

"The easiest mode of effecting this is by piling iron ballast on the wall. If a sufficient quantity cannot be obtained to load the whole at once, or if the hindrance to the use of the wharf would be the less by loading only a part at a time, the laying on the ballast may then be extended at one time no farther than from crack to crack of the wall, and so on progressively over the whole that has failed, forcing it down *separately* in *portions*, however much one portion may be pressed down more than another on account of difference in the firmness of the ground; and this although it be very probable that some farther cracks may be occasioned by the operation.

"Supposing pigs of ballast of three hundred weight each to be laid across the wall close together, it would require them to be piled up ten pigs in height."

Such were his instructions to his assistant in the architectural department; they are remarkable as exhibiting a new expedient, that of pressing down a wall not originally carried down to a sound foundation; and they afford an example of the part he took himself in the contrivance of every work that came under his cognizance, as also of the distinctness of the instructions he was in the habit of giving to his subordinates. They were followed by directions as to the repair of cracks, the adding to the thickness of the wall, and the puddling in behind it.

This manner of *repairing* a wall is analogous to the mode he invented for the construction of foundation walls on bad ground. (See *Mechanics' Magazine*, Nos. 1300 and 1310, particularly page 282 of the latter number.) The principle of *weighting* walls till they find a firm foundation is applicable in many cases where failures have occurred from the same cause as the injury to the wall at Deptford, and that in the instance of minor works as well as in those of magnitude; and as to new works, the recent accident to the bridge for the railroad to Windsor, affords an example where, had the piers been weighted previously to building the superstructure, no such unfortunate failure would have occurred. M. S. B.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 1ST OF NOVEMBER, 1849.

BARTHOLOMEW BENIOWSKI, Bow-street, Covent Garden, major in the late Polish army. *For improvements in the apparatus for and process of printing.* Patent dated April 26, 1849.

These improvements refer to a system of printing from types arranged on the inside circumference of a cylinder, which was the subject of a patent granted to the same gentleman in 1847.

1. He now proposes to coat the nick and

back surfaces of the types, for about one-half their length from the foot, with two or more layers of any suitable varnish, and subsequently to dress them, in order to give them a tapering form, and thereby obtain a cylindrical printing surface. When the types are employed to print from the outside periphery of a cylinder, they are, of course, coated from the top downwards. They are cleansed by passing a few blank sheets of paper through the machine, then sponging them with water to prevent the turpentine, with which they are afterwards to be brushed over, acting on the varnish. Blank sheets of paper are subsequently passed through, and the types will present as clean a face as when cast.

2. He further dispenses with the use of the mouth-piece in type-mould (used in his former machine), and makes the channel through which the metal is pumped in the side of the carriage.

3. He cuts notches in the divisions of the case, to enable the legs of the tweezers employed in composing type, according to the patentee's system, to enter and seize hold of such type as may rest against the partitions.

4. He supports the composing stick upon one of the faces of an angular piece of wood, which is attached to the top of a revolving vertical rod, supported in a bracket screwed to the front of the table, to prevent the compositor from being obliged to carry the stick full of type, which often produces deformity by causing one shoulder to be higher than the other.

5. He protects the substance of which inking rollers are composed from atmospheric influences and injury in rapid printing, by inclosing them in tubes of vulcanized India-rubber, or other suitable material, and he makes inking rollers of tubes composed of some impermeable material, filled with water, and fitted with stuffing-boxes at both ends, through which the axle is passed.

6. The patentee next describes an improved concave-cylinder printing machine, which consists of a cylindrical framework, containing the main cylinder, which is driven by a number of anti-friction rollers, arranged around its periphery. The form is fixed on a portion of the inside circumference, and around it are placed the ink-supplying and distributing rollers. The printing roller is placed after the last distributing roller, behind which, and within the main cylinder, are placed the delivery and receiving boards. The paper is placed on the delivery board, underneath the paper-supplying roller, supported in a vibrating frame on one end of a lever, which is made to rise from the paper, just before the arrival of the form in front of the printing roller, by the action of a cam on the edge of the main cylinder. An endless band of blanketing, with strips of some sticky substance upon its external face, is passed round the paper-supplying roller, so that at each fall and rise they will lift up a sheet of paper by adhesion. In front of the supply roller, and supported in the vibratory frame, are several wires, the free ends of which take into the spaces between the strips, and throw the paper down, which is still slidden forward until it is laid hold of by a projection in front of the form, and thereby drawn between the printing roller and the type. At each end of the main cylinder is a polished "skating rail," above which revolves an endless band, with "skating pieces" attached thereto, while beneath is the receiving board. As the printed sheet issues from between the printing roller and the form, it is pressed by the skating pieces upon the skating rails, and thereby pushed up them until the pieces come uppermost, and consequently allow the paper to fall through the rails on to the receiving board beneath. Two or more of these apparatuses may be adapted to the cylinder, so that the same number of impressions may be struck off at each complete revolution; and the vibratory frames may be worked by a boy instead of by cams, on the other edge of the cylinder.

Claims.—1. The mode of manufacturing type for printing from a cylindrical surface, by coating a portion of their nick and back surfaces with some suitable varnish.

2. Making moulds for casting types with channels in the side, and dispensing with mouth-pieces.

3. The cutting notches in the partitions of cases.

4. The arrangement of apparatus for supporting the composing-stick.

5. The mode of protecting the substance of which inking rollers are composed from injury, either from atmospheric influence or the centrifugal force developed in rapid printing, by inclosing it in a tube of vulcanized India rubber, or other suitable material.

6. Manufacturing inking rollers of tubes composed of some impermeable material, and filled with water.

7. The arrangement of apparatus for feeding-in the paper.

8. The arrangement of apparatus for delivering the paper.

9. The employment of strips of some sticky substance for lifting the sheets of paper successively.

10. The apparatus for causing the blanketing which carries the strips to fall and rise with sheets successively.

11. The substitution of a sliding motion for a rolling one, in printing.

12. The adoption of any of these methods to other printing machines.

William Kilner, Sheffield, engraver. *For improvements in manufacturing railway and other axles and wheels; and in machinery to be employed in such manufacture.* Patent dated April 24, 1849.*

1. The inside surface of the tyre, after being bent into a circle, is raised to a welding heat by placing it in a hollow fire or closed hearth, after which it is laid on a block, and the spokes, previously heated at one end, are successively welded to it. The nave is composed of two half naves formed of bar iron coiled into rings, with the internal hollow of less diameter at one end than the other; and the inner ends of the spokes are arranged upon the face (with the smallest bore) of one of the half naves, and the corresponding face of the other half nave laid on them. Care is taken to leave a space between each pair of spokes, and to punch holes in them, in order that the inside surfaces of the half naves may be welded together at those points. The nave and spokes are heated to the welding point by being placed above the fuel in a furnace, the top of which is made moveable for the purpose of admitting the wheel, after which they are welded together by swages, and the small ends of the half naves welded over the ends of the spokes. Or, two chains, united by a right and left hand screw-coupling, and passing through the centre of the wheel, are attached to the opposite sides. The wheel is placed in a projecting hearth above the fuel, and when heated to the proper degree of temperature, the chain is tightened and the weld formed.

Instead of welding the spokes to the tyre after the latter has been bent into a circle, they may be welded to a straight bar of iron, which is then bent to the required shape around the ends of moveable blocks arranged to form part of a circle, with intervening spaces to receive the spokes.

2. To give the necessary rotundity to the tyre a bed plate is employed, which has a central vertical shaft, on which the wheel is placed, and is free to revolve thereon. Around the rim are two pairs of equidistant rollers, supported on spindles in the ends of four levers, the other extremities of which encircle two screw rods, whereby they can be made to approach or recede from the tyre, while above and beneath it are two other rollers capable of being brought closer together. The rollers are driven by toothed gearing from any prime mover, and communicate their motion to the wheel. The felloe is formed with a dovetail, and the edge of the tyre bent over it by the action of the rollers. An adjustable scraper is made to act against the tyre, for the purpose of cleansing it.

3. For the purpose of turning the tyres, the patentee employs revolving circular cutters keyed on a shaft, resting on moveable bearings, which can be made to slide up and down simultaneously by means of a hand screw.

4. The axles are constructed of two tubes, placed one within the other, or of a tube filled with bar iron, and welded at the ends only, or of a number of bars of iron, curved and overlapping one another, to give a spiral direction to the fibre.

Claims.—1. The use of the hollow fire or closed hearth for heating tyres to the welding point.

2. The projecting hearth.

3. Heating the inside surface of the tyre by causing the flame and products of combustion to impinge against it, instead of by radiation.

4. Heating the spokes and tyre together, in order that they may be welded at the same heat; and arranging the spokes which have holes punched in them, at a distance from each other, between two half naves, to allow of the surfaces of the latter being welded together at these points, as well as over the ends of the spokes.

5. The employment of two or more rollers acting uniformly and capable of being caused to approach or recede from the tyre, in conjunction with the scraper, for the purpose of rolling and cleansing it.

6. Boring and turning the inside and outside surfaces of railway wheels by revolving circular cutters.

7. The compound hollow axle.

8. The railway axle composed of a tube filled with bar iron welded only at the ends.

9. The railway axle with the bars of iron laid so as to give a spiral direction to the fibre.

George Simpson, Newington-butts, chemist; and Thomas Foster, Streatham, manufacturer. *For improvements in manufacturing or treating solvents of India rubber and of other gums or substances.* Patent dated April 26, 1849.

1. Bisulphuret of carbon is placed in an iron still, the top of which opens into an earthenware vessel containing pentachloride of antimony, and a pipe leads from the top of this vessel to the worm of an earthenware condenser. The still and first vessel are heated by steam jackets. The resulting product flows from the condenser to a reservoir, after which it is rectified by lime and is then ready for use as a solvent. Before

* The specification of Mr. Kilner's invention was erroneously stated in our last publication, as being due but not enrolled; the specification referred to was that of Mr. Falconbridge.—See page 431.

rectification the India rubber, gutta percha, or other gum may be immersed in it, or exposed to its fumes and thereby rendered less liable to injury from the effects of cold or heat.

2. Coal oil is purified and rendered applicable as a solvent of these gums by being subjected to a similar process, chloride of lime in solution being substituted for the penta-chlroide of antimony.

Claims.—1. The manufacture of chloride and bichloride of carbon and its application as a solvent of India rubber, gutta percha, and other gums not soluble in water, and the mode of treating rubber, as described.

2. The mode of treating coal oil with chloride of lime, for the purpose of obtaining a better solvent of the before-mentioned gums.

Robert Oxland, Plymouth, chemist, and John Oxland, of the same place, chemist. *For improvements in the manufacture of sugar.* Patent dated April 26, 1849.

The improvements of the Messrs. Oxland are confined to the defeccation and decolorization of sugar, and consist in the employment for the purpose of acetate of alumina. The mode of operation which they prefer is as follows:—The sugar is dissolved in water, and heated to 210° Fah. by steam, flowing through a flat coil of pipes. Carbonate of lime is mixed with this saccharine solution, to destroy the acidity; after which it is run through filter-bags into a shallower blow-up pan than was first used, where it is mixed with acetate of alumina, and boiled until nearly the whole of the acid is evolved, which can be ascertained by testing the steam with blue litmus paper. The pan is fitted with an air-tight cover and pipe for conveying the acid fumes to a condenser, whereby they may again be rendered available for the manufacture of acetate of alumina; whatever quantity of acid may remain in the syrup after the evaporating process is neutralized by the admixture of carbonate of lime. Cane and beet-root juice may be defeccated by this process, either before or after concentration, and clarified by the employment of albumen, bullock's blood, or other well-known agent, in the usual way. The acetate of alumina is precipitated by the addition of tannin, in solution. The acetate of alumina is prepared by mixing with a solution of sulphate of alumina a solution of soda-ash, so as to produce an alkaline reaction on reddened litmus paper. The mixture is allowed to precipitate, and the clear liquid is decanted off. The precipitate is removed and washed repeatedly with water, until the hydrometer fails to indicate the presence of any soluble matter; the acid is then added in sufficient quantity, but not in excess, to form the acetate of alumina. The solution of tannin is composed of crushed valonia, in water. The quantity of acetate which the patentee employs for 1 ton of average sugar is 4 lbs.

Claim.—The use of acetate of alumina in the defeccation of saccharine solutions, and removal of colour during the refining of raw sugar.

Charles Iles, Bordesley Works, Birmingham, machinist. *For improvements in manufacturing picture-frames, inkstands, and other articles in dies or moulds; also in producing ornamental surfaces.* Patent dated April 26, 1849.

1. Mouldable articles are to be manufactured with veined or marbled surfaces by mixing with the plastic material employed differently coloured silk waste or other differently coloured fibrous substances. The plastic material preferred is composed of 4 parts of resin, 1 part of wax, 6 parts of glue, 4 parts of alum, and 12 parts of gypsum. The resin and wax are first melted in any suitable vessel, and the glue added; the alum and gypsum are then well incorporated, and, lastly, the waste silk is stirred in. The whole is then ready for being moulded into the desired shapes.

2. Ornamental surfaces on walls and other places are to be produced by mixing with Keene's, or any suitable cement, differently coloured silk waste, or other differently coloured fibrous materials, (in the same way as hair is stirred in mortar;) the mixture being afterwards floated on the walls in the ordinary manner.

Claims.—1. The mode of manufacturing picture-frames, inkstands, and other articles in dies or moulds, by combining with the plastic material employed differently coloured waste silk, or other differently coloured fibrous material.

2. In producing ornamental surfaces on walls and other places by combining differently coloured silk waste, or other fibrous material, with a suitable cement, which is floated on it.

Thomas Harcourt Thompson, Blackheath-hill, C.E. *For certain improvements in apparatus for preventing the rise of effluvium from drains, sewers, cesspools, and other places, and in apparatus for regulating the level of waters in rivers, reservoirs, and canals.* Patent dated April 26, 1849.

1. To "prevent the rise of effluvium," &c., Mr. Thompson uses a trap made of a cylinder with a hanging bottom and a spring catch or click, which falls down suddenly when the refuse has accumulated in the cylinder beyond a certain weight, and allows it to fall through, after which the bottom returns to its first position; and, in order to render the trap more air-tight, a ring of vulcanized India rubber or gutta percha is

interposed between the bottom and the lower edge of the cylinder.

2. A similar apparatus is adapted to the pans of water-closets, and connected with the water-supply pipe, so that the fall of the bottom turns on the water to wash round the pan, and *vice versâ*.

3. To regulate the level of water he employs a ball-cock which consists of two vertical pipes sliding tightly one within the other. The inner pipe is connected to the water main, and contains a cone fixed on the lower part of a rod, which is attached to the top of the inside pipe. A piston, the top surface of which is equal in area to the bottom surface of the cone, is attached to the bottom of the rod, and water caused to flow into this space. By this arrangement the pressure will be balanced, and free passage given to the water to the inner tube, whence it flows out through two prolonged arms to the cistern. The outer tube passes through, and is attached to an air-tight ball, and is provided with two long slots, to allow the projecting arms (which serve to carry the water clear of the ball) to pass through. As the cistern fills, the ball will move upwards, carrying with it the outside pipe, and consequently the cone, which will have the effect of cutting off the water.

4. A self-acting apparatus is described for opening sluice gates, according to the level of the water upon one side; it consists of two cylinders, communicating with the water and fitted with two hollow pistons, which are respectively connected to the two ends of a cross-bar attached, in the centre, to the top of a vertical rod fixed to the sluice gate.

Claims.—1. The arrangement of apparatus for preventing the rise of effluvium from drains, &c., by means of a hinged bottom acted on by a spring click; and the ring of India rubber or other suitable material.

2. The constructing of apparatus for trapping water-closet pans, and turning on the water.

3. The construction of apparatus for regulating the level of water in reservoirs by means of two pipes sliding one within the other.

4. The construction of apparatus for regulating the level of water in canals, &c., by means of sluice gates worked by hollow pistons.

WILLIAM HENRY BURKE, Tottenham, manufacturer. *For improvements in the manufacture of air-proof and waterproof fabrics, and in the preparation of caoutchouc and gutta percha, either alone or in combination with other materials, the same to be applicable to articles of wearing apparel, bands, straps, and other similar useful purposes.* Patent dated April 26, 1849.

1. Mr. Burke proposes to employ a compound of antimony, instead of sulphur, for the purpose of rendering caoutchouc, gutta percha, or their compounds permanently elastic and unaffected by changes of temperature. The compound is prepared by mixing 1 part of crude antimony with 25 parts of crystallized carbonate of soda or 20 parts of carbonate of potass, and 250 or 300 parts of water. The mixture is boiled from half-an-hour to three-quarters, and allowed to precipitate, when the supernatant liquid is run off. The precipitate is then dried and incorporated with the caoutchouc in a masticating machine, in the proportion of from five to fifteen per cent. When bands or other articles are to be cut from blocks of caoutchouc, it is taken, while warm, from the masticating machine, and subjected to pressure for one or two days.

2. It is also proposed to manufacture driving bands by spreading the material, dissolved in a suitable menstruum, with calender rollers upon pieces of calico or other fabric powdered with French chalk, to allow of the easy separation of the two; and to increase the rigidity and durability of gutta percha driving bands, strips of some fabric are to be affixed to the wearing parts, and both surfaces coated with the antimonized caoutchouc.

3. To remove the shiny appearance of single texture garments, &c., Mr. Burke coats them with the antimonized caoutchouc, dissolved in some suitable menstruum, and mixed with ground silk or cotton, which is stated to have the effect of giving the article the appearance of cloth.

4. Gutta percha soles and heels are proposed to be defended at the edges, where they are exposed to great wear and tear, with metal tips, shields, and guards.

Claims. — 1. The treating caoutchouc, gutta percha, or their compounds, with the antimony compound.

2. The mode of manufacturing driving bands.

3. Coating waterproof articles with antimonized caoutchouc, mixed with ground silk, cotton, or wool.

4. The manufacture of gutta percha soles and heels with metal tips, shields, and guards.

JOHN HORSLEY, Ryde, Isle of Wight, practical chemist. *For certain improvements in preventing incrustation in steam and other boilers; also for purifying, filtering, and otherwise rendering water fit for drinkable purposes.* Patent dated April 26, 1849.

The first branch of Mr. Horsley's invention consists in the employment of various well-known chemical agents to precipitate the calcareous and other "adventitious mat-

ters" held in suspension in the water. To "purify, filter, and otherwise render water fit for drinkable purposes," he draws off, by a syphon, the supernatant liquid from the precipitates.

ALPHONSE GARNIER, late of Paris, but now of South-street, Finsbury, merchant. *For certain improvements in extracting and preparing colouring from orchil.* (A communication.) Patent dated April 28, 1849.

M. Garnier remarks, that in extracting the colouring matter from lichens, according to the present mode, the lichens are bruised or crushed, and placed in a trough containing water, along with the alkalies for extracting the colour, where they remain for several months, until they assume the consistency of paste which contains, besides the tinctorial extract, ligneous particles, resinous and chlorophylous gums, and other unimportant substances. Now the object of the present invention is to separate the tinctorial from the foreign matter, previously to operating on it with chemical agents, by crushing the dye lichens, and washing, boiling, or distilling them to obtain a decoction, which is to be filtered for the purpose of separating the ligneous particles. Liquid deuto-chloride of tin is then added, and allowed to precipitate, after which the liquid is poured off, and the remaining precipitate is the substance, from which the colouring matter is to be extracted by the application of known chemical agents.

Claim.—Operating upon the colouring matter of dye lichens, or orchil, alone with chemical or physical agents, and obtaining it in a purer state.

JOHN BARSHAM, Chelmsford, Essex; *for improvements in separating the fibre from cocoa-nut husks.* Patent dated October 26, 1849.

Pieces of cocoa-nut husks are to be subjected to the action of a pair of crushing rollers, revolving at different speeds, in consequence of the difference of their diameters, and having longitudinal grooves on their peripheries, the dragging effect of which will separate, or partially separate the fibre from the husks. The husks which may be either used wet or dry, are afterwards subjected to the action of a series of rotary combs in the following manner:—Three or more cylinders, fitted with comb teeth in their peripheries, are mounted on a common axle, and have each in front a sliding rest, upon which the piece of husk (the point being previously cut off,) is held by the workman, who, at the same time, pushes it towards the comb, whereby the fine fibre will be combed out. It is then passed in to the next comb, and so on throughout the series.

Claims.—1. Partially separating the fibre from cocoa-nut husks by passing pieces of them in a dry or wet state between a pair of rollers.

2. Separating the fibre from the husks by submitting them to the action of rotary combs.

Specification of English patent Due, but not Enrolled.

WILLIAM FALCONBRIDGE, Long-lane, Bermondsey, Surrey, *for improvements in the manufacture of hose, pipes, dressing bands and valves for atmospheric railways.* Patent dated April 26, 1849.

NO ENGLISH PATENTS SEALED THIS WEEK.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Oct. 25	2072	Henry & Robert Smith	Birmingham	Deflective plate-gas burner.
27	2073	William Cook	Regent-street	Hydraulic-gas stove.
,,	2074	Arthur Hills	Woodside, Croydon	Metallic carboy basket.

CONTENTS OF THIS NUMBER.

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No. 1370.] SATURDAY, NOVEMBER 10, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

SHARP'S REVOLVING-BLADE PADDLE-WHEEL.

Fig. 1.

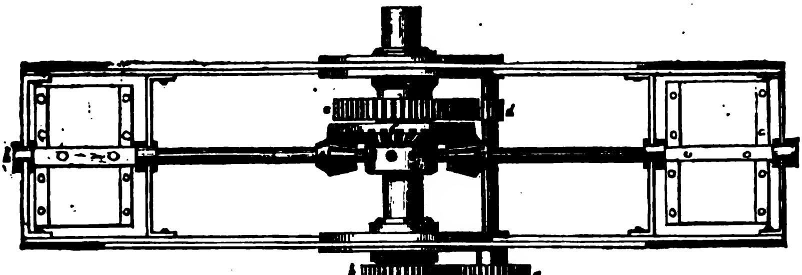
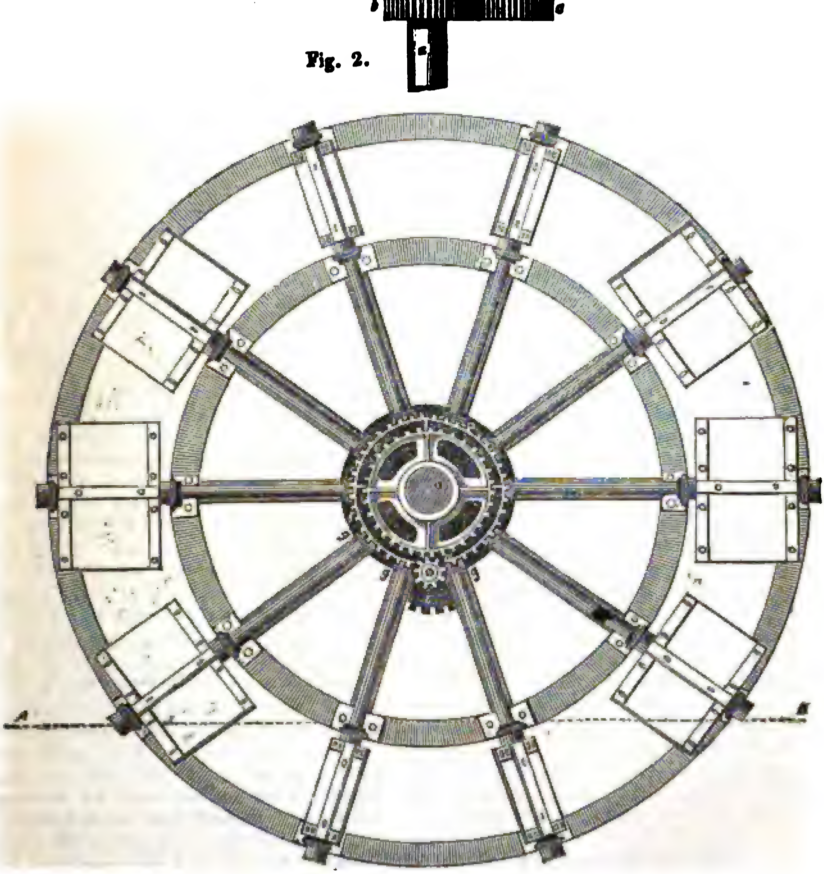


Fig. 2.



REVOLVING-BLADE PADDLE-WHEEL.

Sir,—Of all the purposes to which steam power is applied, there is none in which that power is more wasted than in steam navigation, while at the same time there is none where the economical use of that agent becomes more imperative. It is not only the cost of fuel, and the additional weight and size of engines, but there has to be added the freight lost for cargo, which the vessel otherwise might have taken, it may be, as in our Atlantic steamers, a distance of 3,000 or 4,000 miles. We hear much of the slip of the paddle and the slip of the screw, and these are brought forward apparently for the purpose of, or as data for, showing the loss of power that arises in those different means of propulsion, than which nothing can be more absurd, as that slip which takes place will only be in proportion to the power beneficially employed or given out by the propeller, and the weight it has to overcome in propelling the vessel. This power may be so increased in proportion to the resistance to be overcome, that very little slip shall take place; but this would not show that no loss of power originally given out by the *engines* had been lost, but only that the power employed was relatively great to the tonnage of the vessel, or the resistance thereby to be overcome.

Our best means of arriving at the loss of power which takes place in our present modes of propulsion, would be to compare them with sailing vessels.

Take a ship of 800 or 1,000 tons, sailing under a brisk gale of wind, it will be found that, with all the canvass such a vessel can have beneficially set, she can never have a propelling power arising therefrom greater than 80 to 90 horses power. Yet, with this power directly applied, the vessel will progress 10 or 12 miles per hour. Now, to obtain the same speed with a steamer of similar tonnage, engines of at least 350 horses power would have to be employed.

There can be no doubt, if we except the size of steamers, the strength, power, and finish of their engines, there has been no improvement of any consequence made in them since their first introduction on the Clyde by Henry Bell. True, the paddle-wheels have been relatively very much increased in diameter, and also in breadth; the blades have been made numerous, and placed frequently in two or three separate pieces on the paddle arms, leaving openings between; all having in view the same purpose—to facilitate the entrance and exit of the blades to and from the water, and to give a greater degree of smoothness to the sailing of the vessel, as well as to the working of the machinery; and no doubt such arrangements become absolutely necessary while *fixed blades* are maintained.

There can be no question that the best form of blade for reaction on the water, is that whose surface contains the greatest area under the least circumscribing line, and that instead of their being placed close together on the circumference of the wheel, they should only be near enough to keep up a continuous action of little more than one blade in the water from each wheel. I need scarcely say that at present the paddles in use are the very reverse of this; here the blades are placed close together, so as to keep up a continuous action of beating the water, the disturbance created by the first, facilitating the entrance of the following, while in leaving, the water continues to be carried round with the wheel almost to the centre line of the shaft. The blades are usually in length four, eight, or twelve times their breadth, according as they are placed in one, two, or three pieces on the paddle arm.

There can be no doubt that were the paddle improved and properly adapted to the work it has to perform, the by far more indirect action of the screw could have no chance in competition with it, as it most certainly has now. From 30 to 40 per cent. of the whole power is lost from the indirect action of the blades alone, excluding that which arises from water lifted by the wheel, and this in a favourable state of immersion of the blades. I need not say how much this loss is increased when the immersion is unfavourable, or the vessel tossed about on a tempestuous sea, and the waves are rolling to a considerable height; the speed of the engines may be thereby reduced to one half their usual velocity, and consequently to one half their usual power, and even that power exerted in the most irregular manner, from the

maximum speed down to the stopping point of engines. This greatly reduced quantity of power given out by the engines is also applied through the paddles with a greatly reduced propelling effect, in consequence of the much increased disadvantageous application of it, and this both together combine to render the steamer almost powerless, at a time and under circumstances when power is of the greatest importance.

Another very great evil resulting from the same cause, is, that the sudden sinking and rising of the paddle-wheel acts on the engines in a very prejudicial manner; by sudden shocks straining every part of them, for the engines may be working at their maximum speed and be instantly reduced to the minimum velocity, or it may be to a stand still altogether. Thus, were it not for the great strength, of which the parts of the marine engines are now composed, frequent accidents would be inevitable; but as it is, it must have a very bad effect on the parts of which the vessel, as well as the engine, are composed, as all must be aware who know anything of the strain encountered, in suddenly checking the motion of ponderous machines.

The only attempt to improve the paddle-wheels of importance to notice, is that of feathering the blades as they come to the water, so as they may strike with their edges, their sides both at entering and leaving, forming nearly right angles with the water's surface. This, no doubt, was an improvement, so far as it enabled the engines to work at a more regular speed, in a varying state of immersion of the blades; but then it introduced an evil as great as that for which it provided a remedy, from the blades taking the water on edge, and their sides forming a serious obstacle to the progress of the vessel; as at the point where they take and leave the water, the motion of the blades towards the stern must be much slower than that of the forward motion of the vessel, or at least than what it ought to be; and this serious disadvantage goes on increasing with the depth of immersion.

It is some years since that a knowledge of those evils I have above enumerated led me turn my attention to the subject. The accompanying sketch will show the principle on which I would have paddle-wheels made, although not precisely the mode in which I would carry it out. It will, however, be sufficient to explain the principle to those interested in steam navigation; and should I meet with those who may be disposed, and have facilities for introducing it, I shall be happy to give further information.

Figs. 1 and 2 represent side and end elevations of a paddle-wheel; in fig. 1, only two of the blades are shown, for the purpose of showing how they are geared more distinctly; and in fig. 2, the outer rings and arms are removed for the same purpose. The wheel, *b*, is fixed to the side of the vessel, concentric with the paddle-shaft, *a*, and into this gears the wheel, *c*. On the same shaft with the wheel, *c*, is a pinion, *d*, giving motion to the wheel, *e*, which turns loose on the paddle-shaft, and has attached to it the bevel wheel, *f*, into which gear the pinions, *g*, on the paddle arms. The whole is calculated so as to cause the paddle blades to make one revolution in one revolution of the paddle wheel. The paddle arms move in the centre bearing block, *h*, firmly fixed to the paddle shaft, and have collar bearings at *z*, *z*, as shown in the figures.

Suppose the line A B, (fig. 2,) to represent the water line, the blades will then take and leave the water at an angle of 45°, and it will only be when the paddle arm gets to a vertical position that the blade will be in the most favourable position for propelling the vessel.

The advantages which would be derived from a paddle wheel on this principle are: 1st. The loss from indirect action of the blades would be very much reduced. 2nd. The loss arising from back-water, or water lifted by the wheel, would be altogether obviated. 3rd. The evils arising from a varying state of immersion, as in vessels going a long voyage, from the consumption of coal, as well as in the far more serious matter of a rough rolling sea, cannot with this form of paddle exist, as the water might reach above the centre of paddle shaft, without reducing the speed of engines, and very little impairing the propelling effect. 4th. The diameter of the paddle wheel, and more particularly the breadth, would be very much reduced, thus diminishing materially the surface of the paddle-box, the large extent of which is in

high winds so detrimental to steamers. 5th. Little or no swell would attend their motion, which in river steamers would be a great improvement. And, 6th. From the mode in which they may be made, they would be quite applicable as submerged propellers.

I have no doubt that were this description of paddle introduced, one half of the power now absorbed in steamers might be saved, that is to say engines of 300 horses power would do the work that requires 600 horses power now.

I am, Sir, yours, &c ,
W. D. SHARP.

Swindon, Wilts, Nov. 2, 1849.

RUTHVEN'S PATENT FOR EXTINGUISHING FIRE.—A MODERN ANTIQUE.

Sir,—Were it not for the undeviating accuracy with which the enrolment of patent specifications is reported in your pages, we might be permitted to doubt the fact of such a specification as that of Mr. Ruthven (*vide* page 381), bearing date in the present century.

This patent is invalid from want of novelty, as also from the defectiveness of the title, which represents it to be "for improvements in *preserving life*, &c.," whereas, the specification is for improvements in *apparatus for extinguishing fire*. It would perhaps be difficult to fix the precise antiquity of a fire extinguishing apparatus composed of "an elevated tank with a descending main, screw couplings, stop-cocks, flexible pipes and directors," as patented and claimed by Mr. Ruthven. Certain it is, however, that such an apparatus was recommended and fully described by me in your Magazine for January 5, 1828. Again; in an article on the *extinguishing of fires*, written by me in 1834, for the "Engineers and Mechanics' Encyclopædia," is the following: "The simplest contrivance for extinguishing fires, is by means of an elevated reservoir or cistern, a pipe from which proceeds through all the floors of the building,* with a cock and screwed nozzle in each, to any of which a flexible hose and director can be affixed. On turning the cock, a jet of water rushes out with a force proportionate to the height of the reservoir, which can be thrown into that part of the premises, where the fire is situated. This arrangement is particularly useful in large manufactories or warehouses."

Strange to say, since the date of this last publication, the plan has been twice patented (by Mr. Topham first, and now by Mr. Ruthven). The great utility and advantage of the arrangement are evidenced by its employment for some time past, at the British Museum, Somerset-House, and many other public, as well as private, buildings; a fact so notorious, that the patenting and re-patenting of the affair is very remarkable.

I remain, Sir, yours respectfully,
WM. BADDELEY.

29, Alfred-street, Islington, October 30, 1849.

P.S. The remarks of "M. S. B.," at page 423 of your last Number, recall to mind the extensive application of the arrangement recently patented by Mr. Ruthven, which was made of it by Sir Samuel Bentham upwards of forty years ago, and fully described at page 517 of your 47th volume. A patent for this, and other arrangements of self-acting apparatus for extinguishing fires, was taken out, August 30th, 1807, by Dr. John Carey, of Islington. One of his plans is described as a pipe descending from an elevated tank or reservoir, on which there is "a cock, furnished with a hose or tube of leather, or other fit substance, with a pipe or nozzle at the end, so that a person may direct the stream of water where he pleases; and, in this case, the cock, hose, and nozzle may be concealed in a closet."

At the Model Establishment of Baths and Wash-houses, Whitechapel, several large tanks of water were placed over the building, with hose, &c., attached. But on the outbreak of a fire in that establishment on Monday week last, from want of presence of mind and experience in the persons first on the spot, the apparatus proved unavailing, and the flames spread, until the drying room and its contents were destroyed, and other parts of the building seriously damaged.

W. B.

November 5, 1849.

* Mr. Ruthven's arrangement contemplates placing the descending main externally, in which case it would most likely be set fast by the freezing of the water, at the very time when fires are most likely to occur.

"LA PATRIE'S" STEAM PRINTING-PRESS.

Invented and Patented by Mr. Hoe, of New York.

(Translated from *La Patrie* for the *Mechanics' Magazine.*)

The art of printing is, without doubt, one of the finest inventions of the human mind: thanks to it, nothing dies; great men and great things escape from oblivion. John Gensfleich, of Mayence, surnamed Guttemberg, was not the sole inventor of this sublime art, for the ancient Greeks and Romans were acquainted with the use of moveable types, and notes of invitation, printed by this method, have been found among the ruins of Herculaneum; while in China and Japan, tabular printing has been employed for the last sixteen hundred years. Several historians go so far even as to assert that Guttemberg was not the first inventor in Germany, and state that a sexton, Laurent Coster, of Harlem, was seized with the idea when walking in a wood, to cut letters in relief on pieces of beech bark, which he afterwards employed to print verses and short phrases for the instruction of his grand-children. Assisted by his genius, he invented an ink more viscous and adhesive than had hitherto been used, with which he printed the "Speculum Nostræ Salutis" in Flemish, and illustrated with cuts.

Laurent Coster, after having produced several works alone, employed workmen to assist him, one of whom named Faust, who had been initiated into the secrets of the invention, and had sworn never to reveal them, took advantage of his master's absence at midnight mass to fly, carrying with him the implements necessary for printing.

This unfaithful servant went into partnership with John Guttemberg in Mayence, 1450, and subsequently set up in Paris, where he died, after having been accused of sorcery for selling Bibles printed in red ink.

From this infancy of the typographical art to the great achievements of our days, there is an entire world. Never was seen such a rapid progress,—never did so extraordinary a revolution occur,—above all, in so few years. One man alone appears, however, to have driven it to its last entrenchments—Mr. Hoe, of New York, the inventor of the steam press of *La Patrie.*

This machine, which we have added to our stock, prints 133 copies in a minute, and has exceeded this number—the speed being limited by the aptitude of the workmen to supply it with paper.

When *La Patrie* was first printed by this machine, the boys could not feed it with more than 4000 sheets an hour; but once accustomed to the machine, they have often attained the enormous quantity of 8,760.

During the last four months it has been constantly at work, and the proprietors, or, rather, managers of the paper, are so well pleased with its performance, that they have ordered another upon the same principle, but with six cylinders, capable of printing 12,000 copies in an hour. They expect to have it in full operation within the next four months.

In spite of the immense results of Mr. Hoe's press, a few lines will be sufficient to explain its principle of construction, which is remarkably simple.

[Our contemporary then gives a description of the machine, which is necessarily little more than a translation of what has already appeared in our pages (see vol. xlix., p. 193), and concludes as follows:]

"Such is the work of Mr. Hoe, which, by the exactitude of its performance, appears to be the perfection of typographical art. As yet, it forms the summit of that splendid monument of intelligence of which Laurent Coster and John Guttemberg laid the foundation.

"As is seen, we are far beyond the time when human knowledge was transmitted to the public by the pen of man; and in order that some idea may be formed of the difference in speed between the ancient and our present mode, we submit to the attention of our readers the following calculation:—A copy of *La Patrie* contains about 4,320 lines, and 8,000 copies would give 34,560,000 lines. An experienced hand can write three line in a minute, so that it would take him 192,000 hours to produce 8,000 copies; or it would require 192,000 men to write what Mr. Hoe's press prints in an hour—that is to say, one-half of the French army."

ON THE PHYSICS OF STEAM. BY THOMAS PROSSER, C.E., NEW YORK.

[From the *Franklin Journal.*]

The object in view in the following remarks is to elucidate some of the mysterious actions of steam, but more particularly in reference to its economic value as a motor, in the steam engine, when working expansively.

It has not, therefore, been thought desirable to make the title cover more ground; for instance, the electricity and electro-chemical operations of steam, which may be incidentally touched upon, merely to connect with, but not to explain, which must be left until another time, and it may be to abler hands.

Reasoning "by analogy," has probably

been the cause of as much erroneous doctrine in the church as any other thing which can be named, and so long as the churchmen were the principal depositaries of science, it was not to be expected that this same source of error would be carried there also, but this science was principally of the speculative kind; and yet we find grave professors of the exact sciences of the present day, with the old abomination of substituting fancy for fact. I will instance the fact of high-pressure steam not scalding the hand. The explanation given in the books, to account for this phenomena, is "by analogy," the production of cold by expansion. It is admitted that low-pressure steam will scald, and therefore the "analogy" will not hold good, unless the cold produced is lower than the temperature of such steam; accordingly we fined a writer in this journal, who puts it at 88°, (vol. xii., Third Series, p. 193,) he says that steam at 360° Fahr., "expanded to the atmosphere should be 88°. It would therefore rush into the air, and immediately assume the form of water." Now as it appears to me, the very reverse of this is the fact, that is to say, the steam will not condense, and assume the form of water, in consequence of the expansion, and hence it will not scald the hand.

When steam is generated under the pressure of the atmosphere into which it is permitted to escape, whatever of electricity may be evolved is conveyed back to the water from which it was generated, in consequence of the conducting power of such steam, and the hand which is placed in it becomes scalded; because such steam having no power of expansion, must instantly condense on any substance colder than itself, which may be presented to it; but the air, if fully saturated with moisture at the time, will not take up a particle of it, and therefore it must fall down in a fine shower as rapidly as the particles of air and steam come in contact with each other, and the temperature at the instant of condensation of the steam will be scarcely less than 212°, although it will almost instantly assume that of the air through which it falls, and which continually presents fresh cool air to its finely divided particles. The insensible or latent heat which it has given out, from the state of vapour to become water, will amount to 1000°, or six times as much as would raise the temperature of the same weight of water 167°.

High-pressure steam, on the other hand, is almost the very reverse of this in every particular except the last, that is to say, the same weight of steam will raise the temperature of a given weight of water in the same degree, whatever may be the pressure of the steam. This is commonly known as the law of Watt, and has been proved experimentally by M. Clement and others; and although the recent laborious experiments of M. V. Regnault show that it is not correct, it is nevertheless likely to maintain its position among practical men, on account of its simplicity and sufficient accuracy for ordinary purposes. The experiments of Pambour are said to confirm the law of Watt, inasmuch as steam, "under an absolute pressure, varying from 2·7 to 4·4 atmospheres, and escaping into the atmosphere under an actual pressure of from 1·4 to 1·03 atmospheres, presented at its issue exactly the same temperature as though it were saturated."

These experiments, however, appear to me as proving just the contrary, and support M. V. Regnault's experiments, although it appears to have been entirely overlooked.

If steam after expansion presents the same temperature that is due to saturated steam, at the pressure under which it is expanded, then it is clear that such steam is not saturated but surcharged; because it is a well settled fact that the density of steam does not increase in so high a ratio as its elasticity, and hence the temperature of expanded steam being higher than is due to the quantity of water it contains, proves that the total heat must be greater in high than in low-pressure steam. To give a familiar example, take 100 cubic inches of steam at the pressure of the atmosphere, the temperature 212° Fahr., the weight will be 14·9620 grains; take now also 50 cubic inches at twice that pressure, the temperature will be 250·52° Fahr., but the weight will be only 14·1376 grains.

Again; the weight of 100 cubic inches of steam at 4 atmospheres pressure is 53·2574 grains, temperature 293·72°; expanded into 4 volumes, 100 cubic inches will weigh 13·31435 grains, the temperature due to which as saturated steam is 205°, and the pressure ·8633 atmospheres; such must be the result if the law of Watt be true, but the experiments of Pambour, before alluded to, show that such steam will issue into the atmosphere, at the temperature of 212° Fahr., notwithstanding the cooling it must experience, in passing through the engine, and the improbability of its having entered it perfectly dry.

But one conclusion appears possible, the high-pressure steam contains the most heat; during expansion, the surplus heat goes to surcharge the steam, and make it "dry," and, like hot air at a high temperature, the hand may be held in it with impunity.

According to M. V. Regnault, at 212° the total heat of steam is 1146·60, at 205° it is

1142·57, and at 293·72° it is 1170·72. We have therefore about 28° of heat in steam when expanded four times, more than is due to the water which it contains; the temperature therefore becomes 233° instead of 205°, and the pressure 1·0246 instead of ·8633 atmosphere; no cold is therefore produced by the expansion of steam, as is the case with air. The capacity of high-pressure steam for heat, is greater than that of a low pressure, which is just the reverse of air and the gases generally. Steam, therefore, will not bear compression, because it does not contain a sufficiency of heat under a low pressure to supply the demands of a higher one; and now having arrived at two of the causes which render the working of steam expansively so economical in the Cornish, or any other working by expansion and at a slow speed, viz., the surcharged state of expanded steam, and the liability to condensation by pressure of saturated steam, I close the present chapter, as I hope, without having scalded my hand.

That steam must be either saturated or surcharged will be readily admitted, and therefore, although the fact of its issuing from a high state of elasticity into the atmosphere, at the temperature due to saturated steam under that pressure, does not *per se*, prove it to be surcharged, yet, taken in connection with another fact, viz.: that such steam does not scald the hand, affords certain proof that there is some physical difference between expanded steam and steam which has not been expanded; and as only two states of existence are known—saturated and surcharged—it necessarily follows that, on the score of probabilities, we are entirely justified in assuming that it is surcharged, in the absence of any reliable direct experiments on the subject.

It has been mentioned before that low pressure steam is a conductor of electricity, and I may now add that high pressure steam is a non-conductor,* but what bearing this has on the cause of expanded steam being surcharged it is difficult to say, in the present state of our knowledge of that most mysterious agent; whether, as the cause, in consequence of the electricity being converted into heat, which Pelsier has shown to be possible† or simply as another effect of the same cause.

The electricity of effluent steam was first noticed by an engine man at Seghill, about six miles from Newcastle,‡ England. The first observations on the electricity of a jet of steam, while issuing from a boiler, is contained in a letter addressed by H. G. Armstrong, Esq., to Professor Faraday, and published in the 17th volume of the "London and Edinburgh Magazine," Oct. 14, 1840. There are also some very interesting remarks on the same subject in this Journal, 3rd series, vol. i., p. 123. Evaporation is undoubtedly the great source of electricity in the atmosphere, as well as in the boilers of steam engines, and there appears nothing irrational or unphilosophical in supposing that the converse of this may also be true, knowing, as we do, that heat and electricity, if not identical in nature, are at least mutually convertible into each other.

When the electric spark is passed through oxygen, and hydrogen gases, mixed in the proper proportions to form water, or as eight to one equivalents, a flash is seen to pervade the whole mass, which is instantly changed and converted into steam at a pressure of 14 atmospheres, the temperature of which must therefore be in the neighbourhood of 387° Fahr., even on the supposition that the mixed gases are of the same density as saturated steam, the one at the common temperature, and the other at the elevated one; but how does the matter stand in this respect? $66\frac{2}{3}$ cubic inches of hydrogen gas will weigh 1·412 grains, and $33\frac{1}{3}$ cubic inches of oxygen gas will weigh 11·296 grains, or eight times as much, making together 12·708 grains as the weight of 100 cubic inches. This is about the same weight as 100 cubic inches of steam at a pressure of $25\frac{1}{2}$ inches of mercury, and a temperature of 203° Fahr.; but 14 atmospheres is equal to 420 inches of mercury, and if we imagine that the pressure will increase $\frac{1}{480}$ for each degree from 32°, we have the enormous temperature of 10,262° Fahr., which is but 300° less than the reputed temperature of iron at a welding heat, before the required pressure is obtained; such is the energy with which electricity acts in composing water, when its constituents are thus brought into proximity. The decomposition of water is a very slow process, however, for it is reasonable to suppose that an equal amount of power is necessary, but there are no means known by which sufficient energy of action can be produced to decompose a single drop of water with anything like the rapidity with which the composition is effected. Hence it is difficult to imagine that the decomposition of water in a boiler can take place to any dangerous extent, even under the most favourable circumstances; but it is easy to see that if, under the combined influence of heat and pressure, free electricity should be generated, the sudden opening of a valve may scatter the water

* Journal of the Franklin Institute, 3rd. series, vol. i., p. 125.

† Noad's Lectures on Electricity, p. 250, ¶ 408.

‡ Noad's Lectures on Electricity, p. 252.

among the steam, and if, at the same time, the free electricity be converted into heat, we have ample reasons for expecting an explosion in any boiler so circumstanced, without approaching, except in a slight degree, the temperature which would appear necessary to decompose water.

MM. Jobard and Tassin support some such theory as this, and it does certainly account for many explosions that have taken place, and which no other does account for so rationally.

The cases alluded to are those in which there are several boilers in connection, and which commonly explode simultaneously, or nearly so, just as would be expected where the agent in operation was one of uncontrollable power. It appears to me that, to imagine free electricity as the effective agent in bursting boilers, in such cases at least, is far more rational than to assign it to free caloric, because dry or surcharged steam would appear to be particularly harmless, unless some such agent as electricity is brought to operate upon it; for, as steam, it must necessarily become surcharged by some means before it can be dangerous as an exploder, and the immense quantity of heat to be abstracted from the surcharged steam, and, if you please, from the red-hot boiler also, which disappears or becomes latent before steam of any great elasticity can be formed, precludes the idea of so slow a process as evaporation must necessarily be, unless some new and more energetic medium than ordinary is brought into operation.

To give an illustration of this, let us imagine steam at 100 lbs. pressure to the square inch, the temperature of which will be 329·6 Fahr., and the volume 293 times that of the water from which it was formed; now, in order to double this pressure instantaneously (for it must be remembered that it is almost thus that the most terrific explosions do occur; that is to say, when first set in motion after having been for a time in a state of rest), it is necessary that ·464 times as much water as that which already exists in such steam should be raised, together with itself, 54·8° Fahr.; but this is a small part of the amount of the heat which must be abstracted to effect the contemplated change of elasticity, as 827·6° have disappeared or become latent in the fresh steam generated, being equal to 384° of the whole steam in the boiler, which is now at a pressure of 200 lbs. to the square inch, and a temperature of 384·4°, occupying 147 times the volume of water from which it was generated; thus the whole heat which has to be developed instantly as it were, amounts to no less than 438·8° ($=54{\cdot}8+384°$). It is not very apparent how such an occurrence can take place by any well-known and ordinary means, but if it did, one boiler might burst, but it is altogether inexplicable how all of a suit should follow, as though they were so exactly of the same strength that they must inevitably stand or fall together, which no one at all acquainted with the mechanical skill (or rather the want of it) of some of the western boiler makers, would for a moment suspect. It would rather appear to me that some subtle agent, such as electricity, must be in operation, whose power is so far beyond the elasticity of any boiler, that the strength of the metal of which it may be made is not of the slightest importance.

The electric theory does not appear to be in favour with Dr. Albans, in his very excellent work on the high-pressure steam engine, as it may interfere prejudicially with his pet. The doctor seems to have no opinion at all of steam at less than 8 or 10 atmospheres, to which, indeed, he appears to have descended out of deference to public opinion rather than to his own, as his "first love" was probably much higher, and he has coquetted with steam at 60 to 70 atmospheres pressure.

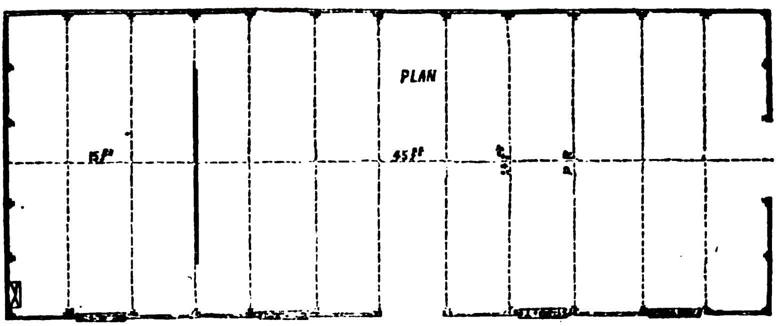
THE HOUSE EXPORT TRADE.

Wherever a new field of enterprise offers itself in any part of the world, there we are sure to see Englishmen or Americans foremost in availing themselves of it, each in the way in which he can turn it most to account. While, accordingly, we behold numbers flocking from our own shores as well as from the United States to the Californian "diggins" to join in the grand scramble going on there for gold—we see others of the stay-at-home class busying themselves (with possibly quite as good a chance of enrichment) in contriving how they may best supply the probable wants of the new population, thus hurriedly gathered together on the northern shores of the Pacific. One sends out forthwith an assortment of clothing; another tools and machines; a third food and drink; and a fourth, houses ready made, only wanting the putting up to be fit for use as dwellings for the "diggers," or store-places for their accumulating treasures.

Among those who have distinguished themselves most in the house-manufacturing line, Messrs. Bellhouse and Co., of the Eagle Foundry, Manchester, deserve prominent notice. The first

Fig. 1.

Fig. 2.



venture they made consisted of two iron warehouses, of the largest of which our Manchester agents, Messrs. Wise and Wood, have sent us detailed drawings, from which the above engravings have been made. Fig. 1 represents an external elevation, and fig. 2 a plan of the structure; of which the following are the dimensions:

	Feet.
Extreme length . .	60
Extreme width . .	24
Height to peak of roof .	17
Height to eaves . .	10
Dwelling-house with boarded floor 24 feet × 15 feet	

Messrs. Bellhouse and Co. have since completed, for shipment to California,

two large dwelling-houses, of which the following interesting description is given in the *Manchester Examiner* and *Times*:—

"These houses of Messrs. Bellhouse and Co., combine elegance and comfort in a surprising degree, considering the material of which they are composed, and are peculiarly fitted for the purpose to which they are to be devoted; namely, the residences or lodging-houses of some of the Californian aristocracy. The extreme length is 27 feet by 22 feet in width; and each house is two storeys in height, each storey containing four rooms, passages, staircase, &c. The lower rooms are 9 feet 3 inches, and the upper rooms 8 feet high, with an additional 4 feet above occasioned by the curvature of the roof. The foundations are similar to those used in the wrought-iron storehouses, viz., strong beams of timber securely fastened together. From this foundation rise strong iron plates and principal, to the roof; and the floors, which are constructed of 3-inch deals, rest on strong angle irons, running along the sides, ends, and divisions. All the divisions and partitions are formed of sheet iron one-eighth of an inch thick, and lined with boards. All the rooms are lined with three-quarter-inch grooved boarding, strengthened by battens, and the exterior of the house is covered with sheets of corrugated tinned iron, averaging 6 feet by 2 feet. These sheets of iron are now merely bolted on, and hence in some places daylight is discernible between them, but on reaching their destination they will be riveted to cross-bars made to fit the corrugations. An immense strength and power of resistance is obtained by the use of this corrugated iron. This may be seen from the fact that the plates which are used in this instance (plates No. 24 wire gauge) are able, when the ends are placed upon supports, to bear the weight of an ordinary-sized individual. It must, therefore, be apparent that an immense amount of pressure from without will be necessary to injure in any way the iron facing of these St. Franciscan residences. The plates are also tinned, or covered with some solution of that metal, by which rust will be entirely prevented—at all events for a long series of years. It also gives to the house a peculiarly light appearance, something like frosted silver; and in a warm climate the advantage of this must at once be obvious: the rays of the sun will be radiated from the surface,—thus the extreme heat, which might otherwise be experienced, will be obviated. The front rooms of the ground floor are 12 feet square, and back rooms 12 feet by 10 feet. One of the upper rooms is 15 feet by 12 feet. The roof, which is curved, overhangs boldly, and the ends will be ornamented by elegant pendants of cast iron. Over the door-way will be placed an ornamental canopy of galvanized iron, and the gutters and spouts are of the same material. The doors are formed of one plate of wrought-iron, with wrought-iron framework on the side next to the passages, ornamented with moulded panel bars, which are riveted to the inside face. The plates are an eighth of an inch, and the bars about half an inch, thick. The doors are provided with brass locks, wards, and furniture. Each of the rooms is furnished with one window, and the casements are affixed to cast-iron frames, in one piece, requiring merely some half-dozen bolts to fix them. They open inwards in two casements, and the panes are cut to a square and diamond pattern. The small diamonds are filled in with red and orange-coloured glass, which gives a beautiful and rich appearance to the window. The outer shutters are composed of strong wrought-iron plates, fastened simply, but very securely. The floors are tongued with iron at each joint, so that they are quite air-tight. The whole of the sides of each room being coated with iron, the doors being made of iron, and the floors being made of 3-inch planks, the houses may be considered fire-proof. At all events, suppose one of the rooms should take fire, it is impossible that it could spread any further than the chamber in which it originated, and the probability is, that long before the roof was properly ignited, the fire could be easily extinguished. The ceiling of the lower rooms will be formed by the under side of the planks forming the floor above, and the ceiling of the upper rooms will be made of three-quarter inch boarding, leaving a cavity above, formed by the curvature of the roof, for ventilation. In the kitchen there is a large fire-grate, with cooking apparatus, and the chimney is carried through the gable end of the building, outside. The whole finishing of the house, the cornices, skirtings, &c., is very superior for houses of this description, and quite equal to that of the most comfortable houses of equal size in this country. Their appearance altogether is extremely pleasing, —picturesque, in fact; and they will doubtless create some surprise amongst the denizens of the "diggins."

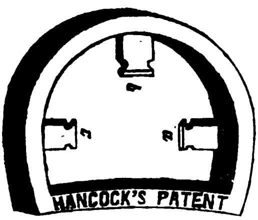
They have been constructed at a very moderate cost—about 450*l*. to 500*l*., we believe.

HANCOCK AND CO.'S PATENT GUTTA PERCHA HEEL TIPS.

Sir,—We are reminded weekly by the advertisement in your Number that gutta percha "must be regarded as one of the blessings of a gracious Providence." Doubtless this, as well as every other natural production, should be so regarded, although in the state in which it is left by Providence it would be of little use were it not for the additional blessings of ingenious-minded men (as the Hancocks and others), by whose skill these crude gifts of Providence are manipulated and presented to our acceptance in a thousand beautiful and highly useful forms.

As weather-proof, and consequently, health-preserving *soles* for boots and shoes, gutta percha most assuredly stands unrivalled. The application of this material to *heels* has not hitherto been equally successful, from its being unequal to withstand the vast amount of wear and tear, to which this part of our understandings is subjected, one consequence of which is its liability to spread, and to become worn and ragged on its edges. For this defect, however, an efficient remedy has been provided in the compound heel tips invented by Mr. B. Tyler, of Sheffield, and manufactured under Messrs. Hancock and Co.'s patent. The frame or border of this improved heel-tip consists of a rim of cast iron or steel, furnished with tangs or projections, *a*, *b*, *c*, fig. 1. This frame is filled up with a

Fig. 1.



tough compound of gutta percha and cork, which encloses the tangs, as shown by fig. 2. The heel, thus formed, requires no nailing to affix it to the boot or shoe, a coating of solution being sufficient for that purpose. Thus arranged, the metal and gutta percha mutually aid and support each other; no spreading

Fig. 2.

can take place, nor can the edges become worn or ragged. These tips never become loose, neither are they liable to become slippery. Having worn them for more than two years, I can with confidence assert them to be the best contrivance extant for this purpose.

In your last Number, p. 430, I see it stated that the specification of Mr. W. H. Burke includes the application of "metal tips, shields, and guards to gutta percha soles and heels." If there be anything new or useful (?) in the patent of Mr. Burke, it will be necessary for him to *disclaim* this portion of it as speedily as possible, to make the other parts valid, inasmuch as he has been long since anticipated on this head by more than one inventor.

I am, Sir, yours, &c.,
WILLIAM BADDELEY.

29, Alfred-street, Islington, November 5, 1849.

Errata.—Page 424, col. 2, 22nd line from bottom, *for* "inopposite," *read* "inapposite."
Page 425, col. 1, 30th line from bottom, *for* "not" *read* "now;" col. 2, 19th line from bottom, *for* "extinguished," *read* "extinguishing."

SHIP-TIMBER SAWING MACHINES.

(From the Catalogue of the Birmingham Exhibition of Manufactures and Art, 1849.)

No. 4.

By Richard Prosser, C. E., Birmingham.

Machine for sawing Ship Timbers, patented by Bentham.

The specification of the above patent is published in the 10th vol. of "Repertory of Arts," 1799, page 239 to 240, and from that description the working model has been constructed by Mr. Richard Prosser, of Birmingham, civil engineer. The object of this machine is to cut the timbers forming the framing of ships, technically called "futtocks." The curve of the futtock is ensured by means of a "template," or guide, and these templates require changing to suit the particular curve and bevil of the futtock.

Owing to prejudices against the use of machinery, and perhaps also to this valuable invention being lost sight of, this machine has not been introduced into Her Majesty's Dockyards. A machine, of American invention, has very recently been erected in Woolwich Dockyard, for "sawing ships' timbers in curved and winding directions," but neither that nor any other machine which has been proposed for cutting ships' timbers are "automatic" in their action; all, except the machine invented by General Bentham, requiring manual aid to guide the saws, and give the requisite bevil to the timbers. Sir Samuel Bentham was, by authority of the Lords Commissioners of the Admiralty, the person who introduced steam engines into the naval arsenals, and machinery set in motion thereby. To him belongs the merit of having introduced Mr. Brunel to the then existing Administration, in consequence of which his block machinery was erected at Portsmouth Dockyard, and is now at work there; but before the introduction of Mr. Brunel's block machinery, General Bentham had erected machines of his own invention for working in wood; in fact, the first sawing machines used at Portsmouth Dockyard for converting the wood for the shells of blocks, were prepared according to the plans and directions of General Bentham. This is mentioned here, to correct a common but erroneous opinion that the machinery in the wood mills at Portsmouth was the invention exclusively of Mr. Brunel. The block-making machinery (including, it is true, the saws and other preparatory machines of General Bentham's invention) effected a saving of 16,621*l*. 8s. 10d. per annum.—Vide *Paper on the First Introduction of Steam Engines into Naval Arsenals, and Machinery set in Motion thereby*, by MARY SOPHIA BENTHAM, Widow of Sir Samuel Bentham.—Weale, 1837.

AMERICAN PATENT LAW CASE.—PLANING MACHINES.

(From the *Philadelphia Evening Bulletin* of June 4, 1849.)

Opinion delivered by JUDGE KANE, *in the United States Circuit Court of the Eastern District of Pennsylvania, in the case of Wilson* v. *Barnum, on a Motion for an Interlocutory Injunction for an Infringement of a Patent for Woodworth's Planing Machine, May* 31, 1849.

A motion is made in this case for an interlocutory injunction, to restrain the defendant from further using a machine which, it is said, infringes upon the complainant's rights under the Woodworth patent. The defendant does not contest the validity of that patent, but he denies that he has infringed it by using the machine complained of, which he asserts to be an independent invention, and as such secured to him by letters patent, recently issued under the act of 1836.

The preliminary question is thereupon made by the defendant, whether a patent issued under this Act of Congress must not, for the purposes of the present motion, be regarded as controlling evidence of title in favour of the party claiming under it.

There are certainly cases under the present patent laws in which the court would enter very reluctantly upon the discussion of the validity of a patent. Some of the provisions of the Act of 1836 give a quasi-judicial character to the action of the Commissioner; and it has accordingly been held, I believe generally as well as justly, that the patent itself is to be taken as *primâ facie* evidence of the novelty and usefulness of the invention specified in it.

There are other cases in which the official action of the Patent-Office claims properly a still higher degree of consideration. Wherever antagonist patentees or third persons generally have been first called in, it is reasonable to consider that action as a preliminary adjudication upon their rights. And this for the obvious reason, that they have been parties, or but for their own default might have been parties, to the proceeding on which the adjudication was based.

But this is the limit, beyond which comity cannot be required to go. It cannot be asked that a third person shall have his legal rights impaired, or his legal remedies impeded, by any proceeding to which he was not, and could not have made himself, a party. To hold ourselves concluded by the action of the Patent Office, where that action has been without notice, would be as perilous to the interest of inventors as to that of the public. We have had in our own court one case at least, in which an injunction was sought against the real inventor on the faith of a patent granted to a surreptitious claimant. The grant of a patent to the defendant, therefore, can have no other effect on the present discussion, than as it indicates the opinion which highly respectable and skilful officers have formed on an *ex-parte* examination of the case.

We come, then, to the principal question. Does the machine now in use by the defendant embody the principle of the complainant's patent?

The judicial definition of a patent, or of the principle it involves, in a case under trial, is properly, if not necessarily, a limited one. It regards primarily, and as a matter

of course, the circumstances of the pending controversy. The identity or the difference between the two machines is sought in the first place by a comparison of them, either in their elements or as a system; and we are commonly said to define their mechanical principles, when, after making such a comparison, we indicate the essential particulars in which they are alike, or otherwise. A new comparison of the patented machine with another not before the subject of adjudication, as it presents new points of similarity or variance, calls for a different expression of the principle of the patent. The aspect of the invention changes as we approach it in a new direction, and parts become prominent that were subordinate before, and that involves perhaps important relations to the question in dispute.

For this reason the cases upon the Woodworth patent, which are found in the Reports, as well as those which have been determined in this Court, give, for the purpose of the present inquiry, an imperfect definition of the principle of the invention. In all of those cases, the machine complained of carried the planks through it on an unvarying plane, which was tangential to the revolving motion of the planing knives, and the planing knives were set on the periphery of the revolver; in both of these particulars resembling the Woodworth machine. In Mr. Barnum's, the cutting tool is set on the face of a rotating disc, and the plank advances in a plane parallel, it is said, with the disc, till the operation of planing is completed, and is then deflected from the machine; thus, at the first glance, differing throughout, as well from the Woodworth machine as from other machines with which the Woodworth has been compared on former occasions.

What then shall we regard as the principle of the Woodworth invention, when viewing it in connection with the machine of the defendant? We shall, perhaps, be led to the answer by tracing the history of this important class of labour-saving machines.

Before the present century, it had been deemed an object of much interest to adapt some combination of machinery to the work of smoothing the surface of boards. The mechanical difficulties in the way were these: 1. That the cutting tools, if made to work parallel to the external surface of the plank, encountering all the sand and grit that adhered to it, soon lost their edge, and became incapable of producing a uniform surface.—2. That if the tools were made to cut otherwise than parallel to the surface, so as to pass *through* the gritty exterior instead of *along* it, the plank would be alternately driven down as the tools struck it, and lifted up as they left it, and would thus have a constant and rapid vibration under the action of the machine.

The engine devised by Mr. Bramah, in 1802, was so contrived as to get rid of the first of these difficulties. His cutting knives were placed on the side or surface of a circular rotating disc; but beyond them, at the extreme periphery, he placed a set of projecting rough cutters, which struck the plank as it advanced in the same plane with the disc, and before it reached the planing knives had removed the outer surface to which the grit adhered. His machine was imperfect, however; for, in consequence of the elasticity of the plank, as well as of the machinery, and the vibration due to the rapid but intermitting action of his tools upon the plank, his cutters, after completing their work, would, as they revolved, come in contact again with the finished surface, and score it irregularly.

Woodworth's machine was the next which I need refer to. He affixed his cutters to the periphery of a revolving cylinder, and advanced the plank towards them, under strong pressure, in a plane tangential to their motion, thus making the cutters describe a curve upwards from the finished surface through the rough surface of the plank, and preventing the plank from vibrating sensibly during the operation. This machine did its work effectively and well. The plank, moving firmly along the tangent plane of the rotating cylinder, passed beyond the reach of the cutters, and was disengaged from the action of the machine at the moment the work was perfected.

This was imitated in the Gay and the MacGregor machines, in which a flattened cone or dished plate wheel was substituted for the cylinder. By this change, the corrugated surface which is left by the Woodworth machine was avoided; the action of the cutters being very nearly in a line parallel to the surface of the plank, and therefore producing shavings instead of the chips which are thrown out by the Woodworth cutters. But as the curve in which the cutters acted became one of a larger circle, the deflexion between it and the plane of the plank's motion was, of course, less rapid than in the Woodworth machine; thus increasing in some degree the liability of the finished part of the plank to receive the same injury from vibration, which was the characteristic defect in the action of the Bramah machine. Nevertheless, when the Gay and MacGregor machines were before this Court some three years ago, it was held that they infringed upon the Woodworth

principle, inasmuch as they contained the revolving cutter acting upon a plank in the tangent plane of the revolver.

The next machine to be described is that of the defendant. Its appearance is, in many respects, similar to Gay's, though it differs materially in others. It has the Bramah disk, with its two sets of rough and finishing cutters; but the plank is made, by a very ingenious contrivance, to advance along a metallic guide, either in a straight or slightly curved line, till it comes beneath the axis of the disk, when, by a turn in the guide, it is bent outwards over a small roller, and thence passes from the machine in a line similar to that by which it approached it. The finishing cutters begin to act upon the plank in a line very nearly parallel to its surface, and complete their work as the plank turns over the roller.

We have thus a machine that cuts in a right plane upon a curved surface, the revolving disk, at the moment of finishing the work, forming a tangent plane to the curve of the advancing plank. We have, too, a roller, over which the plank is forcibly bent, and which, by its resisting pressure against the elasticity of the plank, holds it steady under the action of the cutters: that is to say, we have a machine just the converse as well as the equivalent to that invented by Woodworth. One general expression may include them both. A planing machine in which the cutters and the material move against each other in a curve and in its tangent plane respectively, the material being kept from vibrating by roller pressure. It is true that, in one machine, it is the cutter which follows the curved path, while the material moves along the plane, and that in the other, the cutter moves in a plane, and the material is acted on in the curve; but there is no other difference.

Is this, then, a difference of principle? Can it be said that the essential character of a machine is varied by a mutual interchange of form and direction between the two elements of which it is a combination, while both object and effect remain as before? Does not the question, in its very terms, suggest Lord Tenterden's illustration in the Percussion Lock case, (Webster, P. C. 128,) of those analogous contrivances, the bringing up of an anvil against the hammer, and the bringing down of the hammer against an anvil?

We may recognize differences of details in the defendant's machine, both as to the means and the effect; and these may properly be patented as improvements upon the Woodworth invention, perhaps highly meritorious ones: but considered as independent combinations, I cannot escape the conclusion that, whether the plank on the cutter have the curvilinear motion, if the other moves in a plane, and the two are made to act and react upon each other, for the same object and with the same effect, the machines are in principle identical.

My only embarrassment in arriving at this conclusion has been owing to the fact that, of the highly educated mechanicians whose affidavits have been taken in the cause, the greater number have expressed a different opinion. The consideration, which was so eloquently pressed in the argument, and the responsibility of deciding this question might with propriety be devolved on a jury, has had no influence with me. That judicial morality might be impeached for infirmity, which could shrink from awarding to a party his remedy after ascertaining his rights. "The right of a party to the most speedy and effectual protection against a meditated wrong is as complete as his right to redress for wrongs already inflicted, and the accident of position confers no right on one party, whether he be plaintiff or defendant, at the expense of the other. The special injunction of equity, like the arrest on mesne process at law, may be abused to the injury of an opponent; but it is no less on that account the duty of the judge to further them both, when, in the exercise of his best discretion, he believes that they are called for by the merits and the exigency." This was the language of the Court when this patent was before us formerly, and my experience since has not taught me that it ought to be modified. The preventive interposition of equity is very often the only effective resort of a meritorious patentee; and where the facts of the case are not controverted, I am by no means satisfied that it is not the safest for both parties.

There is no conflict of evidence here: the question is of deduction and opinion. Were the case at this time under trial at bar, it would be the office of the judge to interpret the specification and define the principle of the invention. This is the only point of difficulty, and it must be encountered by the judge, whether he sits on one side or the other of the court.

To send the cause to a jury would be to delay its adjudication for many months; leaving the complainant, in the meantime, with his legal rights suspended, and swelling the measure of the defendant's ultimate liabilities. I should do injustice to both parties, were I, with my present views of the merits of this controversy, to refuse the injunction.

Interlocutory injunction awarded till hearing or further order.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 8TH OF NOVEMBER.

Alexander Munkittrich, Manchester, merchant. *For an improved composition of matters, which is applicable as a substitute for oil to the lubrication of machinery, and for other purposes.* Patent dated May 1, 1849.

This improved lubricating composition consists of 4 lbs. of caoutchouc dissolved in some suitable solvent, 1 lb. of glue, 10 lbs. of carbonate of soda, 10 gallons of animal or vegetable oil, and 10 gallons of water. The water is boiled, and the glue and carbonate of soda dissolved therein, after which the caoutchouc and oil are added, and the whole well stirred together until it becomes homogeneous and as fluent as oil. It is then ready for use, and may be stored in casks and bottles until wanted. The patentee states that any substances possessing the same properties as the preceding, may be substituted for them, and that when the caoutchouc and oil are previously purified, the carbonate may be dispensed with; also, that the proportions may be varied according to the degree of consistency required.

Claim.—The combination of the ingredients before named, or of any substances possessing the same properties, employed to form any analogous compound (whether in the proportions stated or varied to any practicable extent), which may be used as a substitute for oil to lubricate machinery, or for other purposes.

James Wilson, Old Bond-street, tailor. *For improvements in trusses.* Patent dated May 1, 1849.

The spring of Mr. Wilson's truss is so bent that it is made to ascend from the front pad, and passing above the hip, to rest upon it, whence it descends, terminating in the back pad, which presses against the back. The truss is supported by a waste belt or spring.

Claim.—The improved mode of manufacturing trusses, as described.

Mathew Kennedy, Manchester, cotton spinner. *For certain improvements in the methods of packing cops of cotton, and other fibrous materials, and in the apparatus connected therewith.* Patent dated May 3, 1849.

Instead of packing the cops loosely in a barrel, basket, or box, as has hitherto been customary, the patentee proposes to compress them by means of a hydraulic or other press, in order to decrease their bulk, thereby rendering their transit less costly than at present, and to prevent their being injured by rubbing one against the other. For this purpose the cops are packed by hand in a paper bag, contained in a box, and compressed by the descent of a plunger therein, after which the ends of the bag are pasted down and dried. These packets are then placed in a canvass bag contained in a rectangular frame, open at top and bottom, and free to slide up or down, between vertical rods, united by a cross-head, above the ram. Previously to placing the packets in the receiving-box or frame, hoop-iron binders are introduced between it and the canvass, and bent iron plates in the angles to strengthen the corners of the bale. The bottom and four sides are then lined with thin pieces of wood, and the two similarly constructed rectangular hinged frames placed one above the other on the top of the receiving-box. The paper bags of cops are piled in the space thus formed, until they project to the required distance above the top of the last frame, when the uppermost bags are covered with thin slips of wood, and a piece of canvass, having the four corners protected by iron plates as at bottom; vertical chocks, with spaces between them, are then placed on the top of the bale, and between their top ends and the cross-head a horizontal one. The press is put in action, and the cops compressed to a level with the top frame, which is then removed, and the pressure continued until they are on a level with the second rectangular frame, which is also removed, and the cops further compressed to a level with the top of the receiving-box. The hoop-iron binders are then passed through the spaces between the vertical chocks and riveted together, after which the sides of the top piece of canvass and the edges of the bag are stitched together, and the bale is completed.

Claim.—The mode of packing cops of cotton or other fibrous material, as described.

Thomas Wentworth Buller, Sussex Gardens, Hyde Park, Middlesex, Esq. *For improvements in the manufacture of earthenware.* Patent dated May 3, 1849.

Mr. Buller's improvements relate,

1. To the manufacture of "cock spurs" and "pins" for supporting plates and dishes separate from each other in the "saggers" during the fixing operation.

2. To the manufacture of jelly cans.

3. To the manufacture of toy teacups, and similar small wares: and

4. To the ornamenting the surfaces of earthenware articles while in.

1. The cock spurs have hitherto been manufactured in the form of a cone, and the feet joined to the bottoms by manipula-

tion before fixing, whereby a considerable loss ensues from the quantity of scrap waste, and space they occupied in the saggers in consequence of the height. Now this part of the invention has for its object to produce a number of cock spurs complete at each one operation, and of less height than the old ones. For this purpose, a bottom die of type metal is employed with a number of triangular indentations made thereon, and each with a conical hole drilled in it. The indented face of this die is brushed over with oil, and a sheet of clay laid thereon. The top die is composed of a brass plate, with a number of chaffering holes drilled right through it, which correspond with the corners of each triangular indentation, and form the feet. The bottom die, with the sheet of clay in it, is laid on the bed-plate of a fly-press, and the top die is attached to the end of the screw-rod. A piece of turpentined or oiled cloth is placed on the top of the clay, and the top die brought down. It is afterwards drawn up, the cloth removed, and again brought down to form the feet, after which it is a second time drawn up, and the bottom die taken out to make room for a fresh one similarly prepared, and the operation repeated. When the cock spurs are fixed, they are removed from the die. The mode of manufacturing pins to support the finer kind of plates and dishes in the saggers, is precisely similar to the preceding, the form of the die-plates alone being varied.

2. The patentee proposes to mould jelly-cans, instead of throwing them on a wheel and turning them in a lathe, as usual. The mould is placed upon the core, and made open at top to receive and guide a plunger, which, when a sufficient quantity of clay has been supplied, is forced down by hand, after which it is withdrawn, having an axial motion given to it at the same time, tó free it from the clay. A similar motion is given to the mould, which is thereby lifted off the core with the jelly can inside. The can is subsequently pushed out by the re-entrance of the plunger, and dried.

3. Toy teacups are moulded in a die, the bottom of which consists of a disc supported on a revolving spindle, which is connected to a treadle. The top die or plunger is made to act as in the preceding case, and when it has been withdrawn the cup is pushed up out of the lower mould by the ascent of the disc.

4. The ornamentation of earthenware articles while in a green state is effected by engraving the design upon the surface of the mould, and covering it with ink or colour, which is transferred to the surface of the article by pressure.

Claims.—1. The employment of cock spur dies, whereby cock spurs may be manufactured out of sheets of clay, with less waste scrap, and of less height than heretofore.

2. The use of pin-dies.

3. The method of manipulating these articles, whereby their easy discharge from the dies is insured.

4. The mode of manufacturing jelly cans.

5. The mode of manufacturing toy teacups.

6. The method of ornamenting the surfaces of earthenware articles while in a green and plastic state, by bringing them into contact with the engraved surfaces of moulds containing colour.

JOHN DALTON, Hollingworth, Cheshire, calico printer. *For a certain improvement in printing calicoes and other surfaces.* Patent dated May 1, 1849.

Mr. Dalton states that the "lapping" or covering of the printing cylinder, and the endless band of blanketing, used to sustain the fabric, are liable to great wear and tear from the abrasion of their surfaces, and to "flocking," which produces great unevenness of surface, and consequently of printing; and he proposes to remedy these disadvantages by coating the fabric employed, with a solution of gutta percha, in the proportions of 5 lbs. of the gum to 1 gallon of solvent. The solution is placed in the color box of the machine, which is made air-tight, and heated to 150° Fah. (in the case of benzole or bisulphuret of carbon being used, it is heated to 100° Fah., or to from 70° to 80° Fah. respectively.) The solution is conveyed to printing cylinders, or, as it were, printed on the fabric by a roller, placed between it and the color box, which is engraved with a reverse pen pattern, in order to press the solution into the fabric, which is afterwards carried over steam chests and steam drums, to volatilize the solvent, when the gutta percha will be found perfectly adherent to the fabric. Or, the blanketing used to sustain the fabric during the printing, may be composed of two endless webs, having their opposite surfaces coated with the gutta percha solution, and afterwards united into one band by being subjected to pressure and heat.

Claims.—1. The novel combination of materials, their preparation and application to the lapping or covering of printing cylinders employed in printing calico, muslin, paper, and other surfaces, or any modification of them applicable to the same purpose.

2. The novel combination and preparation of materials, and their application to the endless web of blanketing employed in printing, or any modification applicable to the same purpose.

THOMAS WHALEY, Chorley, Lancaster, coal proprietor; and RICHARD LIGHTOLLER, of the same place, cotton spinner. *For certain improvements in machinery or apparatus for manufacturing bricks and tiles from clay and other plastic materials.* Patent dated May 3, 1849.

This invention consists principally in combining the pugging mill, pressing cylinder, screens, and mould-plate in the machine in the following manner:—Underneath the pugging mill, which contains the knives as usual, is placed the pressing cylinder, in a horizontal position, and communicating with the mill. The cylinder is fitted with a piston, worked by a rack and pinion, and furnished with a sliding piece, which as the piston moves to and fro, cuts off or establishes the communication. In front of the piston is a double moveable screen, with the bars arranged vertically, which is made to slide in and out of position by means of a rack and pinion. A second fixed screen, with the bars arranged horizontally, is placed after the first. An inclined shoot is fixed to the frame of the second screen, and is fitted at the opposite end with a mould plate, underneath which are a train of carriages, running on a railway, to receive and carry away the bricks or tiles as they are driven out of the moulds. The distance between each carriage is capable of being regulated by means of a common connecting rod. When the piston is drawn back, communication is established between the mill and cylinder, which is soon filled with clay from the former, through the action of the knives. As the piston advances, the sliding piece closes the communication, while the clay is driven through the screens which retain the stones, &c., out of the moulds, in the shape of long bars, of the depth and breadth required, on to the train of carriages. The bars are then cut into the desired lengths, and the carriages made to convey the bricks to a distance; whence they are taken to be dried. When one-half of the moveable screen becomes clogged, the other half is made to take its place, while it is cleansed by hand.

Claims.—1. The combination of the plug-mill, pressing cylinder, screens, and die plate in one machine, for the manufacture of bricks and tiles.

2. The use of the double moveable screen.

3. The employment of the fixed screen.

4. The construction of carriages for receiving the bricks and tiles as they are moulded, and conveying them away.

JAMES GODFREY WILSON, Millman's-row, Chelsea, engineer. *For certain improvements in the manufacture of glass, and in machinery and apparatus connected therewith.* Patent dated May 1, 1849.

1. The melting furnace is proposed to be constructed with a ring resting on anti-friction rollers, which is made to revolve as occasion may require by means of toothed gearing. Motion is communicated from the outside by a winch-handle. The pots, which are constructed with corrugated or angular surfaces to retain the heat, are placed on the ring, which is fluted at top to allow free passage to the heat. The top of the dome is constructed with a deflecting surface, in the shape of two parabolas joined together at the sides, whereby the heat which escapes from the side of the pots is reverberated on to the surface of the metal. The door or mouth of the furnace is closed by a mouth-piece, having two recesses on the opposite sides, and supported on a spindle, whereby it is made to revolve by any ordinary means. When it is desired to introduce a pot into the furnace, it is placed in the exterior recess of the mouth-piece, which is made to rotate until it is brought inside. The pot is then pushed, by means of tools passing through holes in the mouth-piece, on to the ring, which, by its revolution, carries the pot further into the furnace. The arrangements for withdrawing the pots are necessarily the converse of the preceding.

2. The furnace is to be fed from a hopper through an inclined shoot, in which an Archimedean screw works.

3. The casting table is constructed of cored bars of iron, which are bolted together and heated by the introduction of steam previous to the metal being poured in, for the purpose of preventing the too sudden expansion of the table. It is proposed to place a similarly cored slab of iron, constructed in sections, above the casting table, and resting on ledges on the interior of the sides thereof. Some suitable elastic material is laid on the joints, which, as the air is exhausted from the space between the two tables, is forced in by atmospheric pressure, and closes them hermetically. The mouth of the top table is closed by one half of a cylinder, which fits into it exactly—the other half being cut away, so as to allow the metal to flow in when brought into position by a partial revolution. The table is also provided with a species of safety-valve apparatus for allowing the vapour from the metal to escape.

4. The grinding and polishing table is perforated, and communicates with an exhausting apparatus. Strips of gutta percha or vulcanized India-rubber are arranged upon its top surface, on which the plate of glass is laid. The air is then exhausted from the under side, and the plate secured by atmo-

spheric pressure, without being liable to fracture, during the grinding and polishing process. Or, the top of the table is to be covered with some suitable material, such as gutta percha, which is rendered plastic by the application of heat, and on which the plate is laid, and imbedded by its cooling. When the plate is finished and to be removed, the gutta percha is rendered plastic, as before.

5. Instead of using a "ponty rod" in the manufacture of glass, as hitherto, it is now proposed to employ a rod with elastic arms, which embrace the globe and expand with it when the "flashing" takes place.

Claims.—1. The improvements in the construction and arrangement of melting-furnaces, and in the form of the pots, whereby their removal from and placing in the former is facilitated, and a greater and more uniform degree of heat is obtained.

2. The self-acting apparatus for feeding the furnace.

3. The construction of casting-tables in sections; also the mode of constructing them for the purpose of casting slabs of glass *in vacuo*.

4. The mode of arranging tables whereby plates of glass are retained in position by atmospheric pressure, or imbedded in some plastic material during the grinding and polishing operations.

5. The mode of making crown glass.

William Newton, C. E., Chancery-lane. *For improvements in the Jacquard machine.* Patent dated May 5, 1849. (A communication from abroad.)

The object of these improvements is—

1. To dispense with the use of Jacquard cards and the reader by the employment of an endless band of cloth, of a texture sufficiently loose to allow needles to pass through, on which band the design is produced in gum colours, so as to resist the action of the needles. Or, the pattern may be printed on a fabric in gum colours, as before, and afterwards cut out and attached to the endless band. This band is made to travel at each movement of the treadle about $\frac{1}{24}$th of an inch in front of the sharp-pointed ends of one or more rows of needles, the other ends of which take into spring boxes, as usual. These needles are made with eyes, through which are passed cords, having tongues for working the warp threads attached to their lower ends. These cords are made with knots just above a reed constructed with indentations. The endless band is caused to alternately recede from and advance to the needles, whereby those which come opposite the pattern are pushed back, and the rest held fast. The needles that are pushed back, carry with them their cords, and lodge the knots above the indentations of the reed, so that when the latter is raised up a shed will be formed.

2. To substitute for the harness at present in use the following arrangement:—The headles are connected by cords to levers, the free ends of which rest upon the top of a similar number of vertical rods, underneath which is supported an octagonal "cylinder," each face being furnished with holes corresponding to the rods, and with a stop-piece which is adjusted over one of the holes, as required. The cylinder is made to rise and fall, and to bring each face successively under the rods.

Claims.—1. Dispensing with the use of Jacquard cards, and of the apparatus called "the reader," by the employment of an endless band of cloth on which the design is printed in gum colour, so as to resist the action of the needles.

2. Substituting cords for the ordinary wires in Jacquard machines.

3. The arrangement of one or more rows of needles to be acted upon by the pattern-band.

4. The employment of the arrangement of mechanism for actuating the headles of a loom instead of the ordinary harness.

Samson Wooller, Bradford, York, manufacturer. *For certain improvements in machinery or apparatus for weaving.* Patent dated May 3, 1849.

The patentee describes and claims:—

1. A mode of changing the motion of the pickers.

2. A method of imparting a traversing motion to the shuttles.

3. An arrangement for raising and lowering the shuttle frame.

4. A peculiar construction of loom for weaving fabrics with figures by a separate weft thread, which is not made to traverse beyond the figure.

5. A mode of raising and lowering the shuttle box.

6. A mode of retaining the picker near the extremity of the shuttle box.

7. A method of giving an alternate backward and forward motion to the "cylinder" in Jacquard machines.

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal.*)

For an Improvement in Calculating Machines. *J. J. Baranowski.*

This invention consists of a commercial table or ready-reckoner, containing the various results previously calculated and arranged, consecutively in units, tens, hundreds, &c., as well as in fractional parts

when desired; of suitable apparatus for bringing the numbers of such table into view; of a face plate with openings formed in it, to admit of any portion of such commercial table or ready-reckoner being seen when required; and, lastly, of a number of accurately-filled slides, any number of which can be withdrawn for the purpose of exhibiting the numbers constituting the required result; the other numbers not required for the result to be ascertained being concealed from view. The slides and the face-plate are so adapted and arranged, that the operator may readily see from the front of the machine which slide to withdraw, in order to disclose any result required.

Claim.—A ready-rckoning machine, constructed and arranged substantially as set forth, so that commercial tables or ready-reckoners may be used and read for the purpose for which they are intended, by bringing into view, by a simple mechanical operation, such of the symbols or numbers only as are necessary for, or form part of, the particular calculation or result to be ascertained, the rest of the numbers on the table being at the same time concealed from view.

FOR AN IMPROVEMENT IN COMPOUND RAIL FOR RAILROADS. *Benjamin H. Latrobe.*

The rail is composed of three parts, by which is secured an approximation to a uniformity of strength in the combined bar, by breaking the joints at two points instead of one, which is all that can be effected by the former modes; and it can be applied in many cases where the other could not.

Claim.—The combination of a cap-rail and base-rails, substantially in the manner and for the purposes set forth.

FOR AN IMPROVEMENT IN THE SELF-ACTING RAILROAD SWITCH. *Edward J. Stearns.*

Claim.—The application and hanging of the switch rail, so as to turn horizontally on a pivot, as set forth, in combination with a horizontal lever beneath the flat plate, and a spring acting upon it, and through it, upon the switch rail, and thus keeping the switch rail pressed against the narrow end of the tapering rail, when the cars are not passed through; also in combination with a tilting frame below, and flanch levers resting upon it at one end, and crowning levers at the other, and the arranging of these latter levers so as to arrest the long arm of the one or the other of the horizontal levers, and thus hold fast the one or the other of the switch rails, according as the one or the other side of the tilting frame is depressed by a moveable lever attached to the locomotive or car, pressing on the one or the other of the crowning levers in going towards the turnout, or by the flanch levers at the other end of the frame in coming back on the one or the other track, as set forth.

FOR AN IMPROVEMENT IN FOUNTAIN PEN-HOLDERS AND NIBS. *A. S. Lyman and M. W. Baldwin.*

Claim.—1st. A method of supplying ink to pens from a reservoir in the handle, by means of a bag or chamber, the whole or part of which is made of gum elastic or other yielding substance, substantially as set forth, whereby the writer can, by the pressure of the finger or thumb, supply the nib with ink while writing, and thus avoid the necessity of dipping the pen. Also a method, substantially as set forth, of preventing the escape of ink from the fountain, by combining a spring plug, attached to the cap, as set forth. And finally, making pens by coating or plating quill nibs with metal.

FOR AN IMPROVEMENT IN SELF-LOADING AND SELF-CAPPING REPEATING FIRE-ARMS. *Milo M. Cass.*

Claims.—1st. The employment of an endless chain of cartridge-boxes, open at both ends, for conveying the cartridges in succession to the chamber of the fire-arm, in combination with a table for preventing the descent of the cartridges, and a guide for the ramrod through the same in driving the cartridge from the conveyor into the chamber.

2nd. The employment of a jointed lever, in combination with an endless chain of cartridge-boxes, for revolving the same, propelling the ramrod or piston, and closing the segment stopper into the hollow breech-pin, as set forth.

3rd. The use of a revolving disc of nipples, containing the percussion caps, in combination with the lock, for producing successive discharges, as set forth, irrespective of the endless chain of cartridge-boxes and jointed levers, and other parts of the fire-arm.

FOR AN IMPROVEMENT IN MANUFACTURING SHEET-LEAD. *John Robertson, Brooklyn.*

Claim.—A mode of manufacturing such hollow cylindrical forms of lead, and other soft metals and compounds, into sheets, by first placing them round a roller whose axis may be in a horizontal plane, or in one of any inclination, and then rolling it by any known mechanical means, until it shall be rolled to a proper thickness, substantially as set forth, whereby handling the sheet during the process is avoided, and a continuous rotary motion in one direction may be given to the rolls. Also, the construction of the carrying roller, constructed substantially as

set forth, and the manufacture therewith of hollow cylindrical-formed pieces of lead, or other soft metal or compound, into sheets by rolling, combined with the moveable bearings and pressing roller or rollers, substantially as set forth. And lastly, the manufacture of lead, or other soft metal or compound, into sheets, by supporting a hollow form thereof, and rolling it by one or more pressing rollers, forced against the outside of the form as it becomes thinner, and drawing out the extended form when required.

For an Improvement in Table Cutlery. *Marvin Smith.*

Claim.—Making table knives and forks with the bolster between the blade of the knife (or prongs of the fork) and the shaft, as set forth; also placing the bolster or fulcrum, across which the weight of the handle causes the blade of the knife (or prongs of the fork) to be elevated above the table, nearer to the point of the knife or fork, and farther from the handle, thereby saving the loading of the handle and other consequent injury.

For an Improvement in Machinery for Doubling and Twisting Yarn. *Thomas Lyle.*

Claim.—Constructing the flyer with several divisions, or spaces, for the reception of as many bobbins as there are threads to be twisted, one arranged over another in the same vertical axis, having grooved division plates, guide wires, and hollow journal, through which the several threads from the bobbins are passed, to be doubled, twisted and reeled, in combination with the reel, upon which the threads or yarns are reeled, as fast as they are doubled and twisted—the whole revolving simultaneously in the manner and for the purpose set forth, whether the several parts be combined and arranged as set forth, or in any other mode which is substantially the same.

For an Improvement in Cylindrical Wrought Nail Machines. *Charles J. Richards.*

This invention consists in making a machine to produce nails from rods by means of cylinders, four being used; two of which are composed of a disk, with cams attached to springs, and the centre or disk, while there are two others which are for closing the cams; these cams with the springs connected, are called spring hammers. The two cylinders of spring hammers form the nail on their peripheries, and sides or flanches; these being so shaped as to give shape to the nails. The form of the nail to be produced is formed upon the periphery and flanch of the cylinders; that is, the form of the head is indented into and the points raised upon the surface of these cylinders of spring hammers; so that by passing the rods through betwen the cylinders (the rods being at a welding heat), the rod will be converted into nails.

Claim.—The spring hammers, combined into a cylinder in manner and for the purposes set forth, viz., making nails, spikes, brads, and such like articles.

For an Improvement in Lamps.—*Samuel Rodman.*

This invention consists in an improvement on the Argand lamps, which is in substituting for the tubular woven wick, a series of small wicks passing through perforations drilled in a heavy metallic tube, surrounding the central air tube.

Claim.—The combination and arrangement of the heavy metallic tube or burner, having longitudinal perforations filled with a series of wicks, with the central air tube, substantially as set forth.

For an Improvement in Alloys for Sheet Metals. *Timothy D. Jackson.*

The materials employed in making this alloy are copper 64 ounces, zinc 22 to 26 ounces, India tin 1 to 4 ounces.

For an Improvement in Saw Mills. *William Fink.*

Claims.—1st. The method of changing the motions of the carriage to feed or gig back by the employment of a transverse sliding frame, containing the feed hands, and tappet wheel and pinion; which latter traverses the lines of cogs on the head and tail blocks, and those on the side of the carriage for resetting the log, which feed hands advance the carriage to the saw, whilst the motions of the saw and carriage are continuous and uninterrupted, except by momentary pauses, consequent upon engaging the pinion, with the racks of the tail blocks and carriage, and disengaging it from the rack of the head block, as set forth.

2. The combination of double eccentrics on the levers with single eccentrics for moving the slide to which the log is dogged to the right or to the left, by inclining the lever to the right or to the left, and causing the arm of the transverse sliding frame to actuate the eccentric, previously to reversing the movement of the carriage, and whilst the saw is in the groove of the head block, for setting the log at the head block.

3. The employment of the shaft, pinion, and tappet, cog wheel, and arm, in combination with the main shaft for operating the carridge and transverse sliding frame, and other parts, as set forth.

4. The employment of the transverse sliding frame, in combination with a propelling shaft, pinion, and racks for setting the log

on the head block, and changing the motion of the carriage, as set forth.

5. A method of adjusting the rack for the purpose of leaving a stub short on the boards by bringing the rack into gear with the pinion before the saw has passed through the log, and also a method of sawing *without* a stub short, by bringing the rack into gear with the pinion, after the saw has passed through the log and entered the groove of the *tail* block, effected by moving the slide towards or from the saw, and securing it permanently to the tail block by a pin, which is inserted into a hole in the slide.

6th. The employment of a shield in combination with a ratchet bar and carriage, for preventing the action of the feed hands upon the carriage during the operation of setting large logs by hand.

FOR AN IMPROVEMENT IN THE COMPOSITION OF SLATE PENCILS. *Lewis J. Cohen.*

Claim.—What I claim as my invention, is the mixing or combining, in certain proportions, the materials of alumina (in any of its forms), with French chalk, or with soap stone, in combination with water, for making of a clay or mass for making white slate pencils, and the process of making the same, as set forth.

FOR AN IMPROVEMENT IN FILLING BARRELS WITH FLOUR. *B. Bowman and A. Kauffman.*

Claim.—What we claim as our invention, is a new and useful method of filling flour into barrels in a mill, and weighing the flour and barrel together by one process, by means of a moveable trough suspended on axle points near the centre of its sides, giving a preponderance to that division of it that is farthest from the barrel, and a pair of platform scales fixed below the light end of the trough, upon one end of which scales the empty barrel is placed to receive the flour from the trough, and on the other end the weights are placed, with the end of a lever mortised on it also, which, rising with that end of the scales when the barrel has reached its weight, unloops or unhooks a rod or wire from a pin in the framework above, which stayed at rest an inclination towards the barrel while it was filling, and thus permits the trough, by its unequal balance, to reverse its inclination, and convey the surplus flour into a chest on the opposite side to receive it.

FOR AN IMPROVEMENT IN AN APPARATUS FOR DRAWING AND MEASURING LIQUIDS. *John H. Hecker.*

"The nature of my invention consists in forming, in the tubes through which the liquid flows from the cask to the measure, a segment chamber containing a valve, which is moved up and down, to let on or stop off the flow of the liquid as required, by means of levers, springs, suspended float, and other mechanical contrivances, so combined and arranged, in relation to the valve, as to close said valve and stop off the flow of the liquid from the cask, without the aid of an attendant, by the rising of the liquid in the measure acting on the float, causing the fastening (holding the valve open) to be detached from the lever to which the valve is secured, and allowing the valve to be forced down by a spring pressing against the lever. And also, in combining with the apparatus an alarm bell, which is caused to strike when the valve is closed, in order to call the attention of the attendant to the fact."

Claim.—The mode of measuring liquids by means of the combination of the measure, tubes, valve, lever, hinged bar, catch, roller, springs, cord, and float, arranged and operated as set forth. "I also claim the combination of the alarm with the measuring apparatus, by means of the lever and chain, for giving notice when the measure is filled and the valve or gate is shut, as set forth."

ACTION OF MAGNETISM ON ALL BODIES. BY M. EDMOND BECQUEREL.

At the meeting of the 21st May last, of the Academy of Sciences of Paris, M. E. Becquerel communicated a memoir upon the effects of magnetism upon all bodies, the results of which are given in the *Comptes Rendus* of that date.

The following are the general deductions, the proofs of which will be anxiously looked for by men of science who have paid attention to the recent experiments on diamagnetism :—

1. "All bodies become magnetic, as soft iron itself does, under the influence of a magnet, but in a greater or less degree according to their nature."

2. "The temporary magnetism of a body does not depend upon its mass, but on the manner in which the ether is distributed in the body."

3. "A substance is drawn towards a magnetic centre by the difference of the actions exerted upon this substance, and upon the volume of the medium displaced by it."

The effects were measured by the torsion developed upon small bars of the various substances, by an enormous electro-magnet. The continual oscillations are prevented by suspending under each bar a little sphere of lead or zinc, immersed in water or a solution of chloride of calcium.

"Measuring in this way the actions exerted upon substances moving in different media, I convinced myself of the enormous influence exerted by the surrounding me-

dium. Thus, common glass, which, in the air, is attracted by the two poles of a magnet, is strongly repelled by these same poles when in solutions of iron or nickel: sulphur and white wax, which, in the air, are repelled by the centres of magnetic action, are, on the contrary, attracted when they are immersed in concentrated solutions of chloride of calcium or chloride of magnesium."

The following are his remarks upon the third general law announced above:—

"Thus a body is attracted or repelled by a magnetic centre, according as it is immersed in a medium less or more magnetic than itself; just as a balloon filled with gas falls to the surface of the earth, or rises in the atmosphere, according as the gas is more or less dense than the air. This third principle is, therefore, analogous to the principle of Archimides as to gravity, with this difference—that the latter applies to the mass of the body, while the magnetic intensity developed in a substance by induction in nowise depends upon it. Hence it results that the attractions and repulsions exerted upon different bodies, by either pole of a magnet near which they are brought, depend upon the same cause, and not upon two different orders of phenomena. In fact, under the conditions in which the experiments were performed, the attractions and repulsions follow the same laws, and vary in the same way, proportionally to the square of the magnetic intensity."

To explain the fact that all bodies are not attracted by the magnet *in vacuo*, and that certain substances, such as bismuth, sulphur, phosphorus, &c., are almost as much repelled *in vacuo* as in air, "it is necessary to admit that the etherial medium, by means of which magnetic actions are transmitted, is influenced in the same way but in a different degree in a void space, and in one containing matter; and that a void space behaves like a medium more magnetic than the substance which is most repelled; that is to say, bismuth."

"Certain gases, such as nitrogen, nitrous oxide, hydrogen, and carbonic acid, experience no appreciable action from the magnetism, in comparison with the torsion of a silver wire 0·045 mm. (0·018 in.) in diameter, and 35 centimetres (14 in.) long, but that oxygen is sufficiently magnetic to have its action easily measured. The air is also magnetic, and as its magnetic power is only about the fifth of that of oxygen, it follows that the effect is due solely to the presence of this latter gas."

"While seeking to show the magnetic power of oxygen, by some method other than that by the differences of attraction and repulsion, which show themselves, with small bars of glass and wax immersed successively *in vacuo* and oxygen, it occurred to me to measure the action exerted by the magnets upon little cylinders of charcoal which condense certain gaseous substances in large proportions. I then found that *a small bar of charcoal, which has condensed oxygen, oscillates between the poles of a strong magnet like a small magnetized bar*, whilst, *in vacuo*, it is in general repelled, and always feebly influenced by the action of magnetism."

"Comparing the power of oxygen with that of iron, we conclude that 1 cubic metre (10·78 cubic feet) of air has an action represented by 11 centigrammes (1·65 grains) of iron. If we reflect that the earth is surrounded by a mass of air equal in weight to a stratum of mercury 76 centimetres (30·4 inches) in depth, it may be asked whether such a mass of magnetic gas, continually agitated and submitted to variations, both regular and irregular, of pressure and temperature, does not interfere in the phenomena dependent upon terrestrial magnetism, and perhaps in the diurnal variations of the magnetic needle. In fact, if we calculate the magnetic power of this fluid mass, we find it equivalent to an immense sheet of iron, rather more than one-tenth of a millimetre (0·004 in.) in thickness, and covering the whole surface of the globe."

"Finally, we may then regard as demonstrated the principles announced above, to wit:—that all bodies obey the action of magnetism, but in different degrees, and that the repulsions which show themselves, of the two poles of a magnet upon certain substances, are due to the fact, that these substances are immersed in a medium more magnetic than themselves, which medium, by its reactions, gives rise to the effects observed. I do not, therefore, admit any difference between what has been called *diamagnetism* and magnetism properly so called."

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Cowley, of Walsall, Stafford, manufacturer; and John Hickman, of Aston, Warwick, clerk, for improvements in the manufacture of bedsteads, chairs, tables, couches, and tubular or hollow articles. November 2; six months.

George Park Macindoe, of Mountblow, Scotland, for certain improvements in machinery or apparatus applicable to the preparation, spinning, doubling, and twisting of cotton, wool, silk, flax, and other fibrous substances. November 2; six months.

Adam Cottom, of the firm of John Elce and Co., of Manchester, machine makers, for improvements in machinery to be used in preparing and spinning cotton, and other fibrous substances. (Being a communication.) November 2; six months.

John Jordan, of Liverpool, engineer, for certain improvements in the construction of ships and other vessels navigating on water. November 2; six months.

Lucien Vidie, formerly of Paris, France, but now of South-street, Finsbury, French advocate, for certain improvements in conveyances on land and water. November 2; six months.

Frederick Octavius Palmer, of Great Sutton-street, Middlesex, gentleman, for certain improvements in the manufacture of candles, and also in the machinery for the manufacture of such matters. November 2; six months.

Charles Cowper, of Southampton - buildings, Chancery-lane, for improvements in the treatment of coal, and in separating coal and other substances from foreign matters, and in the manufacture of artificial fuel and coke, and in the distillation and treatment of tar and other products from coal; together with improvements in the machinery and apparatus employed for the said purposes. (Being a communication.) November 2; six months.

Michael John Haines, of Lucas-street, Commercial-road East, Middlesex, leather-pipe maker, for improvements in the manufacture of bands for driving machinery in hose, or pipes, and buffers for railway purposes. November 2; six months.

Hiram Tucker, of Roxbury, Massachusetts, United States of America, for a certain new or improved manufacture of mantle-pieces. November 2; six months.

William Buckwell, of the Artificial Granite Works, Battersea, Surrey, civil engineer; and Joseph Apsey, of Blackfriars, in the same county, engineer, for improvements in steam engines, and in propelling vessels. November 2; six months.

William Morris, of Cold Bath-square, Middlesex, civil engineer, for improvements in the preparing of clay, and in the manufacture of bricks, tiles, and other articles made of clay or brick-earth. November 2; six months.

James Combe, of Belfast, Ireland, engineer and machinist, for improvements in machinery for hackling flax and hemp, and in machinery for producing flax yarns. November 2; six months.

Alfred Barlow, of Friday-street, London, Warehouseman, for certain improvements in weaving. November 2; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery for dressing, shaping, cutting, and drilling or boring rocks or stone; part of which improvements are, with certain modifications, applicable to machinery or apparatus for driving piles. (Being a communication.) November 2; six months.

James Buck Wilson, of St. Helens, Lancaster, rope-maker, for certain improvements in wire ropes. November 8; six months.

Charles Edwards Amos, of the Grove, Southwark, Surrey, engineer, and Moses Clark, of St. Mary Cray, Kent, engineer, for improvements in the manufacture of paper, and in the apparatus and machinery used therein, part of which apparatus or machinery is applicable for regulating the pressure of fluids for various purposes. November 10; six months.

Charles Matthew Barker, of Lower Kennington-lane, Surrey, engineer, for improvements in sawing or cutting wood and metals. November 10; six months.

Richard Ford Sturges and Jonathan Harlow, both of Birmingham, for improvements in bedsteads. November 10; six months.

Enoch Chambers, of Birmingham, smith, for improvements in the manufacture of wheels. November 10; six months.

Thomas Keely, of Nottingham, manufacturer, and William Wilkinson, of the same place, frame-work knitter, for certain improvements in looped or elastic fabrics, and in articles made therefrom; also certain machinery for producing the said improvements, which is applicable in whole or in part to the manufacture of looped fabrics generally. November 10; six months.

Samuel Brown Oliver, of Woodford, Essex, gentleman, for certain improvements in dyeing and dyeing materials. (Being a communication.) November 10; six months.

Henry Henson Henson, of Hampstead, Middlesex, gentleman, for certain improvements in railways and in railway carriages. November 10; six months. To be dated 14th June, 1849. By Writ, &c.

Rowland Brotherhood, of Chippenham, Wilts, railway contractor, for an apparatus or mode for covering trucks and wagons on railways, road wagons, and canal boats, so as effectually to protect goods in the course of public transit from theft or damage, and at the same time to allow of such trucks and wagons being loaded and unloaded with equal facility. To be dated July 18; six months.

The two last patents being opposed, were not sealed till the 10th of November, but bear date the days they respectively would have been dated had no opposition been entered by order of the Lord Chancellor.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Nov. 3	2075	Benjamin Richards......	Dudley Port Foundry, Tipton...	Metallic moulds for casting weights and cable chain, studs and stays.
„	2076	Weiss and Son............	Strand, London......................	Invalids reclining bed couch.
6	2077	William Rye	Oldham	A "Taking-up" roller for power looms.
„	2078	Thomas Tozer	Dean street, Soho...................	The Calorifere.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London, and 99a, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1371.] SATURDAY, NOVEMBER 17, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

DENISON'S MACHINE FOR STRETCHING WOVEN FABRICS.

Fig. 1.

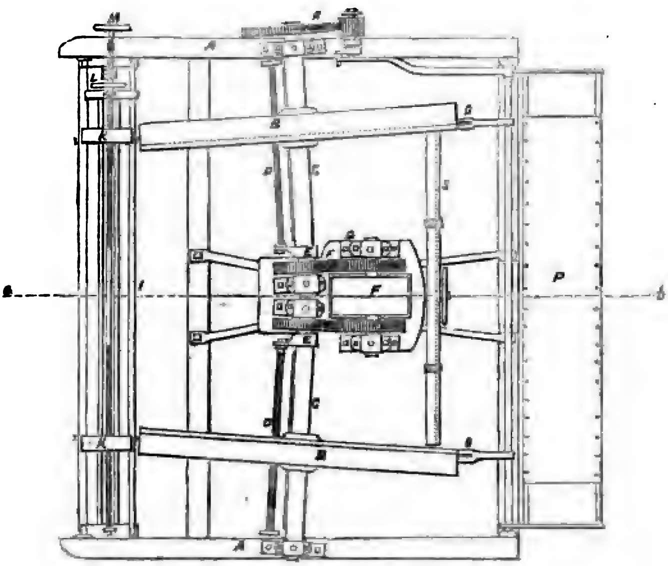
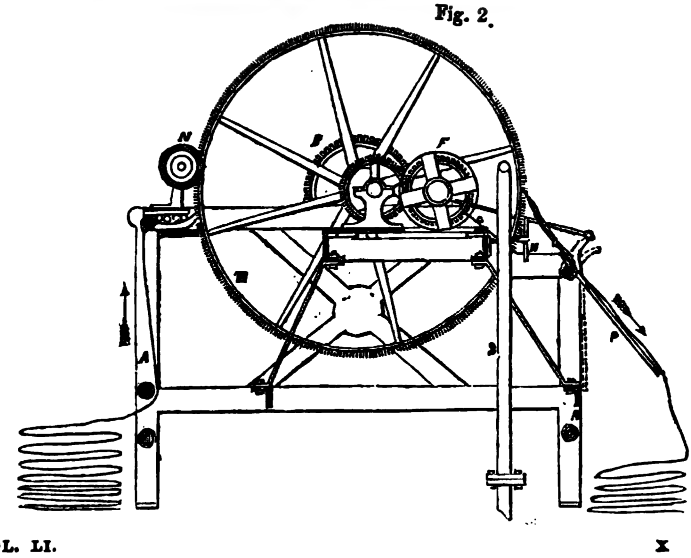


Fig. 2.



DENISON'S MACHINE FOR STRETCHING WOVEN FABRICS.

[Registered under the Act for the Protection of Articles of Utility. Samuel Denison, of Harwood-street, Leeds, Proprietor.]

FIG. 1 of the prefixed engravings is a plan of this machine, and fig. 2 is a sectional elevation on the line *ab* of fig. 1.

AA is the framework; BB, two drums, which are mounted in such manner on the spindles, CC, as that they may be made to travel from or towards the centre of the machine, as may be required. DD are two screws, by which this to-and-fro movement is effected; the screws are passed through the arms of the drums, BB, and work in two fixed arms, EE. FF are wheels for giving motion to the drums; their bearings are affixed to the table, G, which is slid backwards and forwards upon the framework, AA, by means of the hand-screw, H. I is a breastwork of iron bars, over which the fabric to be stretched passes to the drums, BB, to the peripheries of which last the fabric is attached by a number of small pins projecting from their surface, which take into the selvages of the cloth. The degree of stretching to be given to the cloth is regulated by a hand-wheel, H. KK are guides, acted upon by the hand-wheel and screw, L; M is a hand-wheel and screw, which are attached by a swivel coupling to the end of the screw, L, and move both the screw, L, and the guides at the same time. N is one of a pair of revolving brushes, the office of which is to press the fabric on to the pins on the drums, BB. (These brushes stand above the guides, K, and are only shown in fig. 2.) OO are strippers which liberate the fabric from the pins, and pass it on to the cutter, P, which is worked by the gearing, RR. S is a steam pipe (having arms of different lengths), to steam the goods while passing over the drums.

COMPARATIVE POWERS OF DIFFERENT GALVANIC BATTERIES.—HOW MAY HAY BE ARTIFICIALLY DRIED?

Sir,—Your correspondent, of Carmarthen, asks—Why Grove's battery is superior to Daniell's, and Smee's inferior to either? &c. As no one has replied to him, I venture to send my humble opinion on the matter. Grove's battery is excited by a highly oxidating fluid, nearly pure acid, and the hydrogen liberated is removed and absorbed by the nitric acid: in Daniell's battery, the exciting fluid is not so strong as in Grove's, but the hydrogen liberated is instantly absorbed by the oxygen of the oxide of copper, the pure metal being deposited on the negative plate. This removal of the hydrogen is so important an element in the efficient action of a galvanic battery, that, although Smee's contains a more highly negative metal than Daniell's, yet as no provision is made in it for the absorption of the hydrogen, the working power of Smee's is inferior to that of Daniell's. As to the anomalous position of iron as a negative plate, and its superiority over copper in this capacity, if your correspondent will refer to the *Philosophical Magazine* for 1840, 1841, or 1842 (I forget which), he will find the matter elucidated by his fellow-countryman, Mr. Martyn Roberts, who was the first to discover this peculiarity of iron in the battery. His paper on the subject is an answer to Professor Poggendorf, of Berlin. But there is a condition of iron, not yet explained by Roberts, which is its negative character when not associated with other metals, as a galvanic pair, after the iron has been for a short time plunged into nitric acid; but this property is, I believe, easily to be accounted for.

May I, in return for my answer, ask a question. I live not *very* far from the Arctic Circle, and our summer is consequently short and desperately wet. Can any of your correspondents tell me a *cheap* way of drying a field of hay by artificial heat. We should be able to dry, at least, some five tons a day.

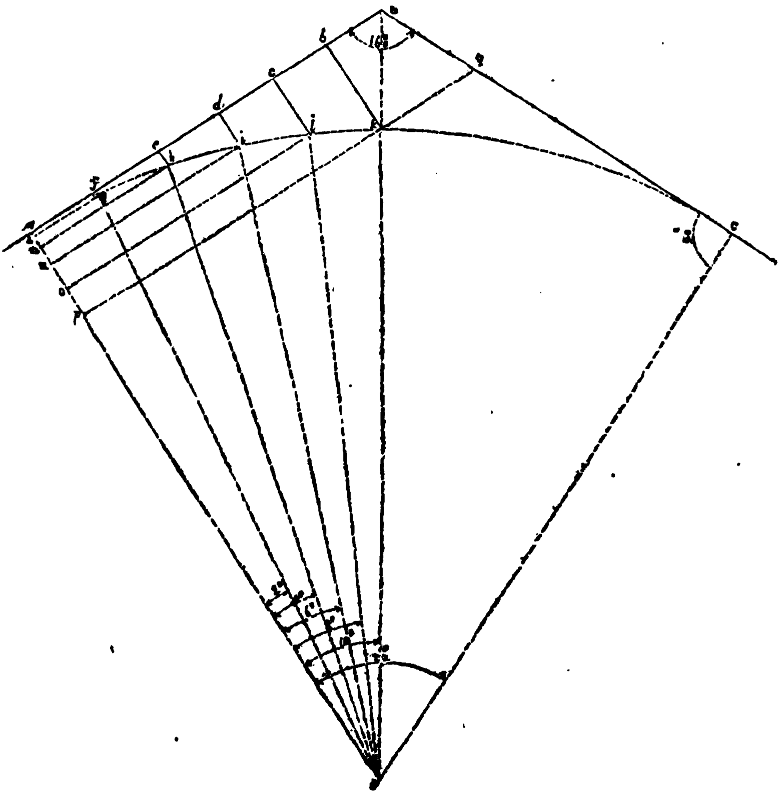
I am, Sir,

Your constant reader,

O.

CONTINENTAL METHOD OF CALCULATING AND SETTING OUT RAILWAY CURVES.

Sir,—The following method of calculating and setting out railway curves may perhaps be found useful by some of your readers. I have used it a great deal myself, and have always found it the most correct, as well as quickest of all other methods, more especially, however, for permanently setting out the line of railway. It is used, I believe, by the engineers of the Ponts et Chaussées in France and Belgium, and on the Continent generally. In the calculations I have employed logarithms, but should any of your readers be unacquainted with their use, the same operations may be performed by common arithmetic.



Now, in commencing the tangent lines, AB and BC, should be run until they intersect at B, and the angle, ABC, taken correctly with the instrument, which angle, we will suppose for the sake of example, to measure 160°, and we will also suppose the radius of the curve in this instance to be 100 chains; it is then required to calculate and set a curve, the pegs of which, may be of equal or unequal distances from each other. The value of the angle, ADC will be 180° − 160° = 20°; then by referring to the accompanying diagram, let AD and CD be drawn at right angles to AB and BC, divide the arc, AKC, or half the arc AK into any number of equal or unequal parts (in the diagram they are equal), and let A, *g*, *h*, *i*, *j*, *k*, be the pegs of the curve; join *g*, *h*, *i*, *j*, *k* to D; also draw *f g*, *e h*, *d i*, *c j*, *b k*, at

right angles to the tangent, AB; draw also $l\,g$, $m\,h$, $n\,i$, $o\,j$, $p\,k$, parallel to AB, then will $Ab=pk$ and $Ac=o\,j$, and also A $p=bk$, and also $Ao=cj$, and so on. We proceed then to find the length of the curve which will be

$$\frac{3{\cdot}14159\times200\times20^\circ}{360^\circ}=34{\cdot}9066 \text{ chains, or by logarithms we have}$$

$$\begin{aligned}
3{\cdot}14159 &= 0{\cdot}4971499\\
200 &= 2{\cdot}3010300\\
20^\circ &= 1{\cdot}3010300\\
\hline
&\;4{\cdot}0992099\\
-360^\circ &= 2{\cdot}5563025\\
\hline
&\;1{\cdot}5429074=34{\cdot}9066 \text{ chains, say } 34{\cdot}90=\text{AKC.}
\end{aligned}$$

Having the length of the curve, we determine the number and distance of the pegs from each other. In this example we have supposed 10 pegs and the length of half the arc being $\frac{34{\cdot}90}{2}=\frac{17{\cdot}45}{5}=3{\cdot}49$ chains distance between the pegs; also the angle, ADC, being 20°, we have $\frac{20^\circ}{2}=10^\circ$, the angle of half the curve, and $\frac{10^\circ}{5}=2^\circ$ the angle of the distances between the pegs. We then proceed to find the length of the tangent lines, AB and BC, which will be as 10,000,000: rad. of 100 chains :: natural tangent of angle 10° = 17.632 chains, or by logarithms, we have rad. of 100 chains = 2·0000000.

$$\begin{aligned}
\text{Log. tangent of } \angle 10^\circ &= 9{\cdot}2463188\\
\hline
&\;11{\cdot}2463188\\
-\text{Rad.} &= 10{\cdot}0000000\\
\hline
&\;1{\cdot}2463188=17{\cdot}632=\text{AB.}
\end{aligned}$$

We next find the length of Af, Ae, Ad, Ac and Ab, by the same operations for the length of the tangent, only substituting the line of the angle for the tangent; thus for lg.

$$\begin{aligned}
\text{Rad. of 100 chains} &= 2{\cdot}0000000\\
\text{Log. line } \angle 2^\circ &= 8{\cdot}5428192\\
\hline
&\;10{\cdot}5428192\\
-\text{Rad.} &= 10{\cdot}0000000\\
\hline
&\;{\cdot}5428192=13{\cdot}4899=lg.=Af.
\end{aligned}$$

Then again, for $m\,h$, Rad. 100 chains = 2·0000000

$$\begin{aligned}
\text{Log. sine } \angle 4^\circ &= 8{\cdot}8435845\\
\hline
&\;10{\cdot}8435845=\\
-\text{Rad} &= 10{\cdot}0000000\\
\hline
&-{\cdot}8435845=6{\cdot}9756 \text{ chains}=mh=Ae.
\end{aligned}$$

Again, for $n\,i$, Rad. 100 chains = 2·0000000

$$\begin{aligned}
\text{Log. sine } \angle 6^\circ &= 9{\cdot}0192346\\
\hline
&\;11{\cdot}0192346\\
-\text{Rad.} &= 10\;0000000\\
\hline
&\;1{\cdot}0192346=10{\cdot}452 \text{ chains}=ni=Ad,
\end{aligned}$$

and so on for Ac and Ab. Having now computed the various lengths on the tangent, we proceed to calculate the lengths of $f\,g$, $e\,h$, $d\,i$, $e\,j$, $b\,k$, by the same rule as before; substituting, however, the cosine for the line of the different angles, and substracting the result from the radius of the curve.

Thus, Rad. of 100 chains = 2·0000000
Log. cos. $< 2^\circ$ = 9·9997354

11·999754
– Rad. = 10 0000000

Rad. = 100,000 chains
1·9997354 = 99·939 chains = l D, and – 99·939

·061 = $f g$.

For $e\,h$, Rad. of 100 chains = 2·0000000
Log. cos. $< 4^\circ$ = 9·9989408

11·9989408
– Rad. – 10·0000000

Rad. = 100,000 chains
1·9989408 = 99·756 chains = mD, and – 99·756

·244 = $e\,h$.

For $d\,i$, Rad. 100 chains = 2·0000000
Log. cos. $< 6^\circ$ = 9 9976143

11·9976143
– Rad. = 10·0000000

Rad. = 100,000 chains
1·9976143 = 99·452 chains = n D, and – 99452

$d\,i$ = ·548

and so on for $c\,j$ and $b\,k$, which will complete the offset from the tangent. Should the point B, be inaccessible, a parallel to AB may be run; as for instance, the line $p\,k$ produced to q, and the angle taken. If the point A is fixed and the radius of the curve unknown, let the operation for finding the length of the tangent be reversed, we will then have,

Log. tangent $< 10^\circ$ = 1·2463188
– Rad. = 10·0000000

11·2463188
—Log. of 17·632 = 9·2463188

2·0000000 – Rad. of curve = 100 chains.

In conclusion, I have to observe, that the only lines required on the ground are the full lines drawn in the diagram, and not the dotted ones.

I am, Sir, your obedient servant,

John Pinchbeck.

Fleet-street, London, November 8, 1849.

EARLY STEAM NAVIGATION PROJECT OF BRIG.-GEN. SIR SAMUEL BENTHAM.

The following fragment of a project for steam navigation is given merely as an example of Sir Samuel Bentham's early turn for invention. The paper is copied from one of some remaining little books in which he noted ideas as they occurred to him: this particular book is not dated, but from internal evidence it must have been written in the year 1774, when he was about seventeen years of age, that is fourteen years before Mr. Symington's steam boat was first tried on Mr. Millar, of Dalswinton's piece of water. The first pages of the little book are wanting, so that Bentham's invention is but very imperfectly indicated by the fragment. Some of the contrivances seem to have been intended for the purpose of simplifying the complication then usual in steam engines themselves, and in the means of applying them to use: his wheels for propelling the vessel were evidently analogous to the present paddle wheels; his project for condensing the

steam to supply fresh water for the ship's crew, affords an example of his attention to the collateral uses to which an invention may be applied; the idea of fixing the wheels in the middle of the vessel, were it realized, would even at the present day be productive of considerable advantage, in war steamers particularly, by placing the locomotive apparatus out of danger from shot, and in regard to all vessels, the enabling them to make use of the whole apparatus, though they should heel so considerably as to raise one wheel as at present out of water.

Bentham was at that period studying naval concerns, as a master shipwright's apprentice, in Chatham Dock-yard, where though little of his time was employed in actual work, yet a Royal dock.yard was not the place for bringing such a project as steam navigation to maturity; besides that, his views tending to the improvement of naval concerns generally, he was led rather to seek an increase of his acquirements by severe study, than in any way to bring forward inventions of his own to public notice.

Fragment of a project for Steam Navigation in the year 1774, by Samuel, subsequently Brigadier-General Sir Samuel Bentham, K.I.G.

Two cylinders at least to each wheel.

Pistons each by rising and falling, to turn the wheel by a crank.

Length of the crank may be commensurate to the power and velocity required.

There may be some apparatus to connect the two wheels, or in the lower part of the cylinders to each wheel there may be an exact fitted plug.

If the plugs of the cylinders of one wheel be unstopped, that wheel would stand still, so may it be guided.

The velocity may be increased by increasing the force of the fire by registers in the furnace.

The upper part of the cylinders may be fitted into a trough of water, then a hole may be made in it, at which when the piston is lifted up, the water will run in to condense the vapour, then the piston will fall; and so on.

The wheels might have leaves, and be put to a boat.

Such boat should be as little as possible above the water, to be affected little by the wind.

For large barges the wheels might be in the middle of the boat, built like two halves at a little distance from each other; the wheels then would not be in the way when coming alongside other boats; and perhaps the water would be smoother between the halves than on the outside.

Query. Is there any better way of producing a circular motion from a vibrating one than by a crank? Probably none more simple.

The piston may terminate upwards in a cogged bar or rack; this rack may turn a wheel when lifted up, which wheel may be disengaged from its axis when the rack falls. There may be a small paul to the wheel, which may catch in the axis; then this paul, when the wheel is turned one way, will catch hold of the axis, and turn it with it.

If sails were set, the wind might assist either B or C*

There may be a hollow tube in the rack, the upper end of which may be stopped by a plug: this plug may be opened when the rack is lifted up to its height, on which the steam would rush out at that hole, and the piston would fall; at the end of its fall, this plug might be made to shut, consequently the piston would rise again, and so on.

The steam when it rushes out might pass down into a receiver at the bottom or side of the vessel, so as to be kept always cool by the contiguous water. By this means a quantity of fresh water would be made continually, so that though it would be necessary to take a quantity of coals, it would not be to take water. This receiver, indeed, would take up some room, but not more perhaps than two quarter casks.

MR. TATE'S DEMI-SEMI-EUCLID.

Sir,—The reviewer of Tate's Demi-Semi-Euclid appears to have been misled relative to the extent of geometrical knowledge required by the Committee of Council on Education, in order to entitle examinands to certificates; and as the remarks made by him are calculated to depreciate, in public estimation, the value of such certificates, I trust you will permit me to correct this mistake. If Mr. Tate asserts in his preface, that three books of Euclid are all that the Committee of Council require,

* It would seem that these letters refer to some sketch made on missing pages.

he only states a part of the truth, since it is only the Third, or Lowest Class Certificate, that can be insured with this limited amount of knowledge; while the examination for the First and Second Class Certificates extends to the eleventh and twelfth books. Even then, unless a competent knowledge of other branches of mathematics and other departments of philosophy and literature be exhibited, the candidate fails in obtaining a certificate higher than the third, or, at most, than some *degree* of the second class. If Mr. Tate meant to say, that three books were all that is necessary for obtaining their Lordship's *lowest certificate*, he should have said so distinctly, and not have deluded the public and reviewers with ambiguous expressions calculated to injure the reputation of teachers who, after a long season of toil, have acquired an honourable status among the scholastic profession, and of an official body (the Committee of Council) who appear desirous of doing the greatest amount of good in the least objectionable manner possible.

Your reviewer, however, has done the public great service in speaking so frankly and fearlessly as he has done of Mr. Tate's works. It is really revolting to see how his works are pushed into the hands of teachers, by the indirect method of making them the text-books in which candidates are to be examined for certificates. I suppose it is taken for granted, that because one or two of his earlier works were good, and were evidently the result of great painstaking, all his other works must be so. The rule-*pro*-reason character of his later works renders them extremely objectionable as books for the discipline of a teacher's mind, however valuable they may be to practical engineers and mechanics, who set a value on results, rather than on the means by which those results have been obtained; while the absence of classification and generalization deprives them of one principal feature which makes mathematical science so useful to the elementary teacher. Nothing qualifies a teacher for arranging, mastering, and delivering "collective lessons" so thoroughly as the power of generalizing and classifying, which may be acquired by a vigorous application to the study of the exact sciences.

I feel bound to thank you, Sir, for your remarks on these works, since it is public opinion which determines the choice of all works issued under the authority of the Committee of Council, and your opinion cannot fail, I think, to have the more weight, from the circumstance of your having been evidently disposed to take as favourable a view of these works as possible.

I am, Sir, yours, &c.,

RHO.-BETA.

[The Reviewer did not mean to ascribe to Mr. Tate the literal assertion, that "the three books of Euclid are all that the Committee of Council require" in every case: all that he intended to express was, that Mr. Tate, by publishing the first three books of Euclid only, seemed to intimate, in a very unmistakeable manner, that *he* thought no more would be required, in the great majority of cases, and was acting on that conviction. Our correspondent's letter is a very good vindication of the Committee of Council on all points save one;—the mercenary and unrebuked use which they allow Mr. Tate to make of the high favour in which he stands with the Committee.—ED. M. M.]

DRAINAGE OF TIDAL TOWNS.

(From the *Times*.)

Sir,—An original suggestion for the drainage of London has just been made by Mr. Goldsworthy Gurney, proposing to take advantage of the tide's running down seven hours and up only five. The paper containing the suggestion has been put into my hands to examine the correctness of certain *data* and calculations necessarily connected with its practical application. I have maturely considered the subject, and have been forcibly struck with its originality, and at this moment, when our attention is so closely drawn to sanitary considerations, deem it important to be put before the public. I have obtained permission to do so, and, if you think with me, it is very much at your service. He says,—"The current of the Thames, in round numbers, at London Bridge, runs down seven hours and up only five every tide; in winter more, in summer less, depending on the amount of river water; it runs at a rate of about from five to seven miles per hour (no matter what the speed, let us suppose it to run at the same rate up and down for our present purpose). It is plain that anything thrown into, and forming part of the Thames at high water, would in seven hours be carried more than forty miles down the river—never to return. In order to make this more clear, let us suppose a portion of sewage (or, what is better a sea log,) to be thrown into the river precisely at high water at London Bridge; in seven hours, taking six miles per hour as the mean rate of current, it would be carried forty-two miles down the river. On the return of the tide, in five hours, the full time of flow, it will only have come up thirty miles, and at the time of high water would be twelve miles below the bridge. The next ebb would carry it forty-two miles further down the river, or fifty-four miles

below London-bridge; at the return of next high water it would be left twenty-four miles down the river, thus descending twenty-four miles in twenty-four hours, until it went clear into the sea. If our numbers are correct (and they are not far rom the truth), it is self-evident that if the sewage of London were collected and allowed to run into the Thames at high water, like the sea-log above stated, it would at low water be forty-two miles down the river; it would never return to pollute the river, for five hours' flow would only bring it twelve miles below the place whence it started."

Then follow some calculations as to levels, interference of rain-water, &c., showing how the present conditions of sewers are to be met, which need not be gone into here. The practice seems true; the principle is self-evidently correct. At the end of the paper appears the following anecdote, which so clearly shows the principle, and is so naturally put, that I cannot help giving it as it originally stands:

"When I was a boy, I was much amused to observe a dead pig flow up and down a tidal river every day. As regularly as the day came, my friend the pig came also; he grew bigger and bigger, and shortened his visits about a mile every tide, until at last he went to sea, and, poor fellow! I never saw him more. He made me a philosopher. What could make a dead pig grow? or why did he choose to shorten his visits so regularly a mile a tide?"

It is clear, following out this anecdote in illustration of our subject, if a "dead pig" were thrown over Waterloo-bridge at low water, he would go up with the tide for five hours, and be five hours more in returning to the same spot; he would now only have two hours' ebb before he met the flood coming up; he would, of course, return with it, go again up the river, and might be seen every day for a week: but if he were thrown over at high water, he would float down for seven hours, he would come up only five, and consequently would never be seen again within twelve miles of Waterloo-bridge. I am, Sir, yours, &c.,

JAMES HANN.

King's College, Nov. 10, 1849.

WARNER'S IMPROVED SOLAR LAMP.

(Registered under the Act for the Protection of Articles of Utility. John Warner and Sons, 8, Crescent, Jewin-street, London, Proprietors.)

Sir,—The extensive and continually increasing demand for artificial light, causes the most extensive competition between gas, oil, naphtha and other luminiferous agents.

Fig. 1.

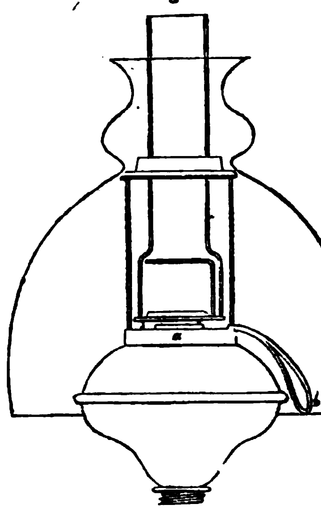
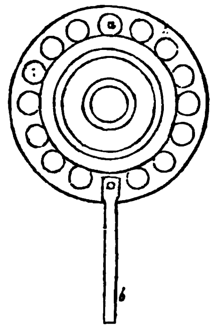


Fig. 2.



Scarcely a month passes but brings forth inventions intended to develope increased illuminating powers, or to effect an important saving, in some of these light-producing substances. Gas is, in some situations, inadmissible, and to some persons always objectionable; naphtha requires so much care and attention to ensure satisfactory results, and has led to so many serious accidents, that preference is pretty generally given to oil lamps, especially those in which the cheaper oils can be successfully employed. Of these the "Solars" have long borne the bell, affording, as they do, a beautiful light with the very commonest oils. These lamps, however, seldom give a good light

for more than five hours without fresh trimming. This defect has been obviated by an important improvement, recently introduced by Messrs. Warner and Sons, by which both the *brilliancy* and *durability* of the light is increased in a remarkable degree. Fig. 1 is an elevation of Messrs. Warner and Son's improved solar lamp, which in the general arrangement of its parts resembles its numerous predecessors; but differs from them in being furnished with a cap-plate, *a*, on the top of the reservoir, having on its upper surface a number of apertures, as shown in the plan thereof, fig. 2. An upright stem from the regulator rises through one of these apertures (*a*), so that in turning the handle *b*, the wick is raised or lowered at pleasure.

In consequence of this arrangement, three different currents of air are directed towards the wick; the first passes vertically up, *inside* the burner, the second passes *horizontally* between the ordinary cap or deflector, and the plate *a*, while a third, passing down through the apertures in the latter plate, forms a vertical current upwards on the *outside* of the burner.

The effect of these three currents of air is, to retard the carbonisation of the wick, to render the combustion perfect, and to produce a light of the most perfect whiteness and dazzling brilliancy from common seal oil, rivalled only by that obtained from naphtha, with this important peculiarity, that these lamps will burn from eight to ten hours without any attention, with undiminished brightness.

B.

DISCUSSION ON RAILWAY AXLES, AND ON THE STRUCTURAL CHANGES WHICH IRON IS SUPPOSED TO UNDERGO FROM VIBRATION AND CONCUSSION.

[*From Report of General Meeting of the Institution of Mechanical Engineers, October* 24, 1849.]

A paper was read by Mr. McConnell, "On Railway Axles."

The scope of this paper was limited simply to the question of the form and dimensions of axles, with the changes and deterioration to which they are subject in process of working, assuming in all cases the material of which the axles are made, and the mode of manufacture, to be of the most approved description. The author states that it has been ascertained, by an approximate calculation, that a journal 1·128 inch diameter, is not capable of sustaining a heavier load when in a state of rest than 2½ tons, or 5600 lbs.; and allowing in practice that the wagon or carriage axle is made ten times the breaking strength, the diameter of the journal would be, adopting the same calculation, 2·43 inches. In these calculations the strength alone is considered, but we have also to take into account the question of friction and likewise the tendency to abrasion. With our present means of information no accurate data are available for determining the best proportion of journal or bearing according to the weight it has to bear, or the velocity at which it is required to move. A great variety of proportion is in use, but it is fair to note that in engine axles particularly, the length of bearings depends to a certain extent upon the construction and arrangement of the engine; as a general rule the length of bearing is not in due proportion, according to our general experience, to the diameter. It has always been considered that having first ascertained, from example and experience, the strength of sectional area necessary under every circumstance to sustain the load which the journal has to carry, the length of it was determined by the velocity or amount of friction to which it is liable. Judging from axles at present in use in carriages and wagons, the length of bearing is twice the diameter of the journal; but on this, as well as other points on strength of material, there exists a great variety of opinion. Even the forms of journals are found to differ very much. Without attempting to decide on the merits of any of them, Mr. McConnell, therefore, in the present instance contents himself with stating, that all his experience has proved the desirableness of maintaining the rubbing or wearing surfaces of bearing as free as possible from sharp abrupt corners, and sudden alterations in diameter or sectional strength. The first strain to which the axle is subject, whilst in motion, is that arising from the weight of the wagon and load, which being received or resting on the journal, produces the greatest effect upon the axle at the outer face of the wheel-boss, and to which is to be added the momentum of the load in falling through the spaces caused by inequalities in the joints of the rails. The injurious consequences upon the axle of inequalities of the road surface, and flat places on the surface of a wheel-tyre, by the jolting or perpendicular motion which they produce, cannot be accurately estimated, and these are very much increased when the bearing springs of

the wagon or carriage are not sufficiently elastic, and do not yield to the shock or blow downwards, so as (to use the expression) to cushion its effect. As an instance of the imperfect action of the springs, Mr. McConnell alluded to those in use on many wagons, in which the form and construction cause them to be so rigid, that the downward blow is more like a hammer upon an anvil. To obviate this strain as much as possible, it is necessary to proportion the spring so as to sustain the load properly, and yet be of sufficient elasticity to absorb the effect of the load oscillation. The strain arising from the oscillation of the wagon on curves from imperfect coupling, is increased by the lateral freedom or space on the bearings or play between the rails and flanges of the wheels; which when an irregularity occurs on the side of the rail, or any sudden cause disturbs the direct motion of the wagon onwards, is in effect the same as a blow upon the flange of the wheel, the radius of the wheel tending to act as a lever to break the axle at the inner face of the boss of the wheel. This strain is in the compound ratio of the momentum of the load, the angle at which the wheel strikes the rail, and the distance from the centre of the axle to the point of impact, producing an effective strain upon the axle at the inner face of the wheel-boss, which extends proportionately over the whole axle between the wheels. To lessen in practice as much as possible the deteriorating effect of these descriptions of strains upon the axle, the following conditions are important:—

That the bearings or journals of the axles fit as closely to the brasses as is consistent with freedom, the allowance of flange-gauge of wheel being quite sufficient for the carriage to move freely round curves and meet any irregularity in the gauge of the rails.

That the wagons or carriages be as equally loaded as possible, and the draw chains be exactly in the centre; and as side chains are dangerous, they should be completely removed, provision being made for a duplicate centre draw-chain should a failure take place. As the damage to the loading of wagons is in proportion to the oscillation, they should all be screwed together by means of screw couplings, having spring-buffers upon both ends of every wagon.

It is well known that the injury to the wagon, to the load which it conveys, to the axle which carries it, and to the road over which it runs, is very much aggravated if the wagons are allowed to oscillate from side to side, and become like so many battering rams, injuring themselves and all substances in contact with them. A train of wagons or carriages should be jointed together similar to the vertebræ of an animal, by which means any sudden lateral action would be neutralised by the support derived from the neighbouring vehicles.

The road to be kept as accurate as possible to gauge and line.

The third class of strains to which axles are liable are the shocks produced by starting and stopping a train, and which are in proportion to the momentum of the wheel and axle at the time of collision when stopping, and to the velocity of the impelling force and the inertia of the wheel and axle when starting; these strains are felt principally on the neck of the journal.

Fourth strain—the torsion or twisting caused by the wheels travelling over curves of the line; the difference in length of surface of the inner and outer rail compels one wheel to grind or slide upon the rail, while the other is free to roll. This strain is proportionate to the load on the wheel, determining the amount of friction upon the rails and the length of axle between the wheels; a slight amount of torsion is also caused by any variation in the diameter of the wheels on the same axle, by any inequality upon each journal, the quality of the brasses, or the amount of lubrication proportionately, and the strain of the break block on one side, because when any of these occur separately or jointly, one half of the extra strain on one journal is transmitted through the axle to the other, and twisting or weakening the axle is necessarily produced. To lessen the amount of the above strain, it is obvious that the wheels should be kept in the best possible state of repair so far as equal diameters and true circular surfaces are concerned, the wagons or carriages should be loaded equally on each side, the journals carefully lubricated, and all break blocks adjusted to bear the same pressure on both wheels of the same axle.

Fifth strain—the constant vibration of the whole axle. This is more particularly the case and is accelerated when the axle is fixed in a rigid, unyielding wheel. Mr. McConnell stated, that his experience has proved that the axles fixed in cast-iron wheels are very much more liable to deterioration than those in wrought-iron wheels, and the jar or vibration tending to deteriorate the quality of the iron, by altering its texture from fibrous to crystalline, is clearly visible in its effects in several fractures. It would appear that the cast-iron wheel acted more like a hammer on the axle, and as in the cold-swagging process, a gradual breaking up of the fibre at the back of the wheel goes on, which is shown by an annular space, varying from three-eighths of an inch to three-quarters of an inch in breadth; the strength is com-

pletely destroyed of this outer portion, and a sudden shock of the wheel upon some point of the road completes the fracture of the axle.

Among other causes which contribute to the deterioration of axles may be mentioned the practice of throwing cold water on the axle to cool it, when it has become nearly red hot from the want of proper lubrication of the journal.

With regard to the strain to which the portion of the axle between the wheels is subject, there can be no doubt if the form of the axle is so proportioned, that any blow transmitted through the wheel is received equally along the whole body of the axle, and the sectional strength at each point is fairly balanced to resist the effect of the blow, the axle will then be best suited to prevent deterioration at any particular place.

[Mr. McConnell then proceeds to give the details of a number of experiments which he had made with the view of determining the weakest point of a common wagon axle under different circumstances.]

The crank axles of locomotive engines cannot be treated by any of the rules applicable to straight axles; and our experience would seem to prove that, even with the greatest care in manufacturing, these axles are subject to a rapid deterioration, owing to the vibration and jar which operates with increased severity, on account of their peculiar form. So certain and regular is the fracture at the corner of the crank from this cause, that we can almost predict in some classes of engines the number of miles that can be run before signs of fracture are visible: a certain amount of injury can be prevented by putting counter-balance weights opposite to each crank, which lessens the vibration very considerably.

The Chairman (Robert Stephenson, Esq., M.P.), said, that Mr. McConnell had expressed a strong opinion, that a change took place from a fibrous structure in iron to a crystalline one during the time of its being in use; and it would be satisfactory if an instance could be pointed out where this change had occurred, owing to vibration or any other treatment, for he had not been able to satisfy himself from many experiments that any such molecular change took place. Hammering a piece of hot iron till it is cold, produced a hardness called crystalline; but the question for consideration was, supposing an iron axle were annealed by heating to a dull red heat and being allowed to cool slowly, would the "texture" of that iron undergo any alteration afterwards from the vibration of the railway or any piece of machinery they were in the habit of employing? He had not been able to detect an instance of the kind; and in giving evidence before the Iron Girder Bridge Commission, he mentioned cases of vibration going on from year to year without any sensible change occurring in wrought or cast iron. For instance, they had the Cornish engine beam with a strain of 50 lbs. per inch, working eight or ten strokes per minute for more than twenty years; and certainly if a molecular change was introduced by vibration, it ought to be by that continual concussion and vibration; but none was perceived. Again, the connecting-rod of a locomotive was a piece of iron in a most perplexing situation, for one having more to do and having the strain changed more frequently it was difficult to conceive; and yet he had known the connecting-rod of a locomotive engine to vibrate eight times in a second for several years' regular work, making more than 200 million times altogether, but the iron retained its fibrous structure; and he thought axles could not be subject to so much vibration. When, therefore, he found that a connecting-rod did not change its molecular texture, he must say there were good grounds for doubting that iron changes it state in axles.

Then with regard to the experiments made by Mr. McConnell, with a view to ascertain where axles were most exposed to tension, he could not quite agree with him, for he subjected the wheels and axles to a slow steadily-increasing pressure, till he bent the axles in different positions. The results were correct as far as regarded the slow pressure on the flanches of the wheel under the circumstances of the experiments recorded by him, but they were not a faithful representation of what takes place in practice, for it would be found that when the wheels of a carriage jarred, a violent blow was inflicted on the rail, and the strain on the axle was totally distinct from a slow pressure.

He would refer to the experiments made some years ago by Mr. John Gray, on the Hull and Selby Railway, and which were published in the *Engineers and Architects' Journal*, or the *Mechanics' Magazine*, to show how important is the element of time in the fracture of an axle. He took a round bar of iron 3 feet long, and 2 inches diameter, and turned it down in the middle, to 1 inch in diameter for 2 inches in length. He then took another bar 1 inch in diameter uniformly throughout, and he tried the strength of these bars under *concussion* and not mere pressure. Now the severest point of strain would evidently be the middle of the bars where the diameter was the same in both, and consequently if weights were gradually and quietly laid on, the results would be alike in both bars; but when small

weights were let fall on them, the bar 1 inch in diameter throughout its whole length was found to be much stronger than that which was in the main 2 inches and 1 in the middle. For as time is an element when the resistance of material is concerned, regarding the axle as elastic like a piece of India rubber, the only particles that could yield to percussion from the falling weight were those between the shoulders in the part of the axle that was turned down, but in the case of the bar an inch in diameter throughout its whole length the whole of the particles would yield; the one being a good spring and the other a very bad one.

It therefore appeared to him that the experiments recorded by Mr. McConnell, though correct as regarded the position in which he put them, were not correct as regarded concussion. The axles rarely, if ever, broke in the middle, but generally at the end close to the boss of the wheel, because of the sudden change in the elasticity of the axle at that point; the portion of the axle fixed within the boss of the wheel being very rigid while the rest remained elastic, which caused the vibrations to be suddenly checked at that point. No doubt the plan of weakening axles in the middle had done good because it made them spring, and in crank axles it relieved the strain in the cranked part.

Mr. Henry Smith suggested, that in the case of bar-iron, the exterior portion had greater tenacity than the interior or under part; and the strength would be more than proportionately diminished where the exterior portion was cut through. He also referred to some experiments in which he had cold-hammered fibrous iron till it became crystalline, and the effect produced corresponded with the description given by Mr. McConnell of the fractured axles.

Mr. McConnell observed, that he had met with several cases of broken axles in which a distinct annular space was observable all round the surface of fracture, that was quite short-grained and appeared changed into a crystalline texture, whilst the centre of the axle remained fibrous. He admitted that his experiments were only approximate, and that he had not put the strain in the natural way; but it was almost impossible to do so, in consequence of the great trouble and expense that would have accompanied it; at the same time the results were proportionate in each case, and the accuracy of the experimental results had been confirmed by calculation. With regard to the axle fitting into the wheel, they now allowed only a very small shoulder, not exceeding a sixteenth of an inch, and this shoulder was not square, but tapered, and the boss of the wheel was slightly coned to fit the shoulder.

Mr. Cowper did not believe that any axle which, when broken, proved to be crystalline, had ever been fibrous in its character.

Mr. Ramsbottom considered that a change took place in the axle from the effect of mere mechanical action, and his observations had tended to confirm him in that opinion. Some time ago he selected an axle which had not a very good form of journal, and the end broke off with two blows of a 12 lb. hammer. This axle had for three years been subject to a strain vertically, which was reversed at every revolution, and it came off with a crystalline fracture. He then tried the part that had been within the boss of the wheel, which had not been subject to this great strain, and found the strength was very much greater than that of the journal, for it required seventy-nine blows to break it off, and in that case the fracture was fibrous. A parallel case might be observed with reference to an ash stick, which, if doubled, would break with a fibrous fracture; but if subjected to vibration, however slight, running through it a great number of times, it would break in a different mode. He thought the strain on a locomotive connecting rod was by no means so great for the sectional area as upon an axle journal; and the latter had two reversed strains for every revolution of the small wheels, but the connecting rod had only two for each revolution of the driving wheels.

The Chairman said, he was only desirous to put the members on their guard against being satisfied with less than incontestible evidence as to a molecular change in iron, for the subject was one of serious importance, and the breaking of an axle had on one occasion rendered it questionable whether or not the engineer and superintendent would have had a verdict of manslaughter returned against them. The investigation hence required the greatest caution; and in the present case there was not evidence to show that the axle was fibrous beforehand, but crystalline when it broke. He therefore wished the members of the Institution, connected as they were with the manufacture of iron, to pause before they arrived at the conclusion that iron is a substance liable to crystallize or to a molecular change from vibration. For his own part, he was now induced to look upon wrought iron as literally elastic, like a piece of India-rubber; for in the case of the Britannia Tubular Bridge, where they had two 10-inch square chains or bars, each 100 feet in length, it was found that before the tube was raised, the chains or bars stretched nearly two inches in length at each time of lifting, but resumed their original length when the strain was withdrawn; the same action being repeated every time the tube was lifted. He

could therefore only regard these 10-inch bars of iron as analogous to a piece of India-rubber.

Mr. McConnell said, he had one specimen of an axle which he thought furnished nearly incontestible evidence of the truth of his position, that a change took place in the texture of the iron. One portion of this axle was clearly fibrous iron, but the other end broke off as short as glass. The axle was taken and hammered under a steam hammer, then heated again, and allowed to cool, after which they had to cut it nearly half through, and to hammer it a long time before they could break it.

The Chairman remarked, that this was a case of converse reasoning; for it was an instance of a piece of crystalline iron being converted into fibrous iron. Iron, when it was once heated, and allowed to cool gradually, acquired a close and fine grain, but it became neither crystalline nor fibrous; if cooled suddenly, it acquired a crystalline grain, and if rolled while being cooled, it became fibrous; but he did not think that it underwent any molecular change from mechanical action after it was cold.

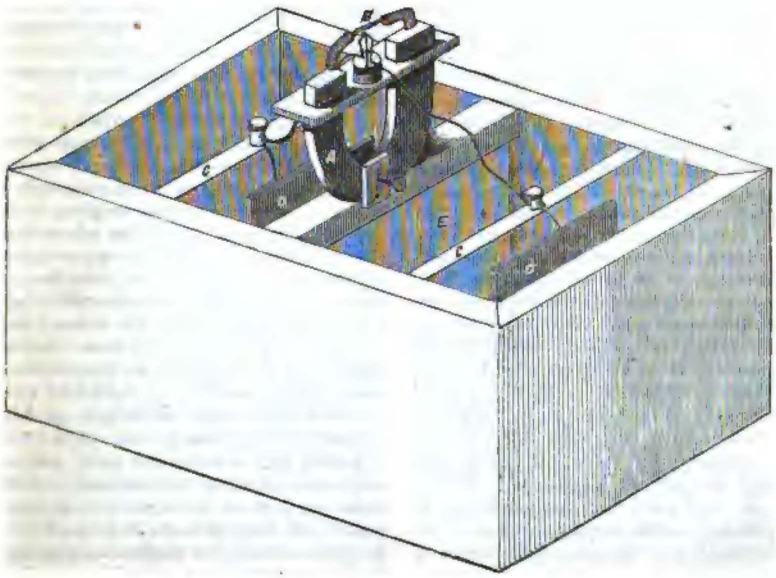
Mr. Henry Smith observed, that throwing cold water upon hot journals did great injury by crystallizing that portion of the axle.

Mr. Slate did not think that any change from a fibrous to a crystalline texture was produced in iron, unless it were strained beyond the limit of its elasticity. Some of the pump rods in Staffordshire, which had been in use for eighteen or twenty years, were subject to a strain of 3½ tons per square inch; and a short time ago he had occasion to ascertain their actual performance with reference to this very question, and this not being considered conclusive, he had made a machine in which he put an inch square bar subjected to a constant strain of five tons, and an additional varying strain of 2½ tons, alternately raised and lowered by an eccentric 80 or 90 times per minute, and this motion was continued for so long a time that he considered it equal to the effect of 90 years' railway working, but no change whatever was perceptible; and therefore he was one of those who did not believe in a change from a fibrous to a crystalline structure in iron. He remembered a case where a question having arisen as to the manufacturers of a certain shaft, it was agreed to hammer it until it split, as a means of discovering the nature of the manufacture of the shaft; the result was satisfactory; and the iron appeared still fibrous in texture.

Mr. Henry Smith promised to furnish some results of cold hammering iron, at the next meeting.

The further consideration of the paper was then adjourned.

NEW METHOD OF ELECTROTYPING.



Sir,—Of all the applications of the electric fluid to the fine arts, none has been attended with so much success as that of copying devices and engravings

already executed; but there is reason for expecting the same success in employing the same power in creating engravings. The methods of producing engravings by voltaism, now employed, are, with the exception of Mr. Palmer's, extremely imperfect. The electrotint, however, is a most excellent way of obtaining pictures; and it is very probable that, by successive improvements, it will be rendered a method by which the most beautiful illustrations will be produced.

The following method of obtaining electrotypes (differing from all others that I know of) will be found very useful, and quite easy to manage, inasmuch as the devices or letters to be engraved do not require to be reversed, as in other engravings, which is an object of great importance; while the execution, in point of beauty and delicacy, may vie with those produced by the immediate application of the graver in cutting the metal. In this manner a plate may be obtained, with drawings or letters in relief, which will bear printing as common wood cuts or metal types.

Take a smooth plate of copper, and cover it evenly with a thin coating of a composition made of one part (by weight) of white wax, two of lard, and one of lamp-black: to render it fit for use, it will be necessary to grind it with a small quantity of olive oil; it must then be melted, and poured over the plate, which must be carefully placed in a perfectly horizontal position. When the mixture has become cold, engrave the design on its surface, so that the bright copper is visible along all the lines, taking care, however, not to scratch the metal in the operation. Any convenient tool may be used, from that employed in cutting the bold lines to the finest pointed one used in shading; but in using those with sharp points, double care is required not to scratch the metal. When the process of engraving is finished, the surface of the coating is to be covered with some conducting substance, so that the voltaic copper may be deposited on it. Various substances have been recommended for this purpose; but none, till lately, answered so well as black-lead. When this is used (and for rougher kinds of engravings it will do very well), it is to be brushed over the composition with a fine camel-hair pencil, blowing away afterwards all particles which have not adhered. But there are great objections against giving to substances a mechanical coating of a conducting material; for in delicate engravings it is impossible to coat the surface and hollows evenly, nor, when coated, to clean all the minute lines without disfiguring them, leaving out of the question the difficulty of making the black-lead adhere to some substances. This difficulty is, however, at once obviated by the discovery of Mr. Spencer, of Liverpool, by which a *chemical* coating can be given to any substance, of such extreme tenuity, yet of powerful conducting nature, that the finest lines are not in the least disfigured, nor the surface of the composition unevenly covered. This process is effected by plunging the substance to be coated into a weak solution of nitrate of silver, and then exposing it for a short time to the vapour of an alcoholic solution of phosphorus, by which means the thin film of the solution adhering to the engraving is deoxidised, or resolved into its metallic state, by the chemical action of the fumes of the phosphorus. It may, perhaps, be better to silver the surface of the plate in this manner before commencing to engrave, for the chance of some foreign substance filling the lines will then be avoided. The plate, after being coated in the manner above described, is to have its back and sides well varnished, so that the voltaic copper may be deposited nowhere but on the face of the engraving. It will be then ready to be electrotyped.

The apparatus for this purpose need be but of the simplest kind. A square wooden box should be procured, with a partition of porous wood dividing it in the middle; care should be taken that the partition is perfectly water-tight, otherwise the operation will soon be destroyed. Over each of the cells thus formed by the partition, fix a small bar of iron horizontally, and from one of them hang the copper plate perpendicularly into the cell, by a varnished wire soldered to the centre of its back; and in a similar manner hang a zinc plate from the other bar, of about the same size as the copper plate, but without any varnish either on it or on the wire. An apparatus of this description, a little modified, is represented in the prefixed engraving. It has the addition of a Ritchie's rotating magnet, which, by constantly breaking

and renewing contact between the two plates, causes the deposition to go on more regularly and faster. It may be used with advantage in producing large engravings where time is an object, and the lines of no great delicacy; but in small engravings which are highly finished the simple box, without the magnet, will answer better. A, represents the steel magnet, with the armature, B, made of soft iron, and enveloped in a coil of fine insulated copper wire; it is suspended on a fine pivot, which proceeds from the centre of the cup on the shelf about the poles of the magnet, the magnet itself being supported in a vertical position by the screw on a stout piece of wood over the partition, E. CC are the iron bars placed over the cells; each has a binding screw on its centre, from which proceed, in one direction, the connecting wires, terminating in the mercury in the cup; and in the other direction are the wires which suspend the plates. The cup is divided in the middle by a partition, the height of which is so regulated that the terminations of the coil which dip into the mercury, may just pass over without touching, while the mercury, from the repulsion which subsists between it and the wood, is divided into two masses, each of which in the middle is higher than the partition. When connection is made between the plates, by placing each of the wires in a separate cell of the cup, observing that each of the perpendicular wires of the coil is also in a separate cell, the armature will instantly revolve, regularly renewing and breaking contact between the plates, the rapidity of which will depend on the quantity of electricity flowing through the wires.

Into the cell which contains the copper plate, pour a solution of sulphate of copper, till the plate is covered, and fill the other cell with water, slightly acidulated with sulphuric acid. If now a metallic connection be made between the two transverse bars, an electric action will take place, generating with the zinc, and passing along the metallic conductors to the copper plate, where metallic copper from the solution will gradually be deposited on its silvered surface. The operation should thus proceed for about a fortnight, when it will be found that the voltaic copper will have acquired sufficient thickness to be separated from the engraving. It must then be fixed on a block of wood, to be of the proper height for printing. The cells must occasionally be supplied with materials as the process goes on, to replenish that which is decomposed; and on no account must the sulphate of copper be left to become weak, for the sulphuric acid which is liberated will become at last strong enough even to dissolve the copper already deposited on the engraving: the copper plate must also be occasionally examined, to see whether the deposit takes place regularly. When the electric action is too intense, the copper will be deposited too fast and rough to fill the minute hollows of the engraving, and will be as brittle as glass; in which case a little water poured into the zinc cell will diminish its energy. And when the operation proceeds too slow, the metal will be as brittle as when it was deposited too fast, although the minute lines may be perfectly filled in the one, and not in the other. There seems, therefore, to be a mean, to be known only by experience, where the deposition takes place to the best advantage, and the copper obtained in this manner is much superior to that metal in its common state, being thereby adapted in a special manner for bearing the pressure of the printing press.

D. JONES.

Carmarthen, Nov. 8, 1849.

PUBLIC EXPOSITIONS OF ARTS AND MANUFACTURES.—THE LAST FRENCH EXPOSITION.

A valuable and interesting report on the Eleventh French Exposition of the Products of Industry has just been prepared and published by Mr. M. D. Wyatt, the architect. This duty Mr. Wyatt undertook at the request of the President and Council of the Society of Arts, having, as he states, in the opening paragraph, in accordance with instructions received from them, visited the French metropolis "for the purpose of collecting all such details concerning the quality, extent, and general character of the exposition, as might seem most deserving of the careful attention of the society." The deep interest which all connected with trade and commerce and the arts in this country have ever shown in the national expositions of France, would of itself warrant a lengthy notice of this report, emanating as it does from the highly-accomplished agent of a body so influential as the Society of Arts; but, in the prospect of a great exposition of

the industry of the world in our own metropolis in 1851, the information that may be derived from such a source becomes still more worthy of publicity on account of the practical bearing which it may have upon that magnificent project.

Mr. Wyatt has classified his facts under three general heads, viz., the present exposition, past expositions, and official arrangements, with an appendix of public documents connected with the organization of the present and past exhibitions; but, before entering on these topics, which comprise the great objects of the report, Mr. Wyatt does not fail to notice the grand results which have followed what he calls the "action of Government on French manufacture." He observes, that when it is considered that during the last fifty years constant and sedulous attention has been paid by Government to the great interests of manufacture, by precept, example, premiums, public exhibitions, elementary schools, &c., and, "above all, by an incessant attempt to elevate the social and intellectual condition of all engaged in the great work of supplying the necessities, gratifying the tastes, and ministering to the resources and revenues of their native country, we cannot be surprised to find, in the year 1849, that the impulse originally conveyed to manufactures limited in extent, and serving chiefly for the use of a small proportion only of the citizens, has been transmitted through infinitesimal ramifications, until it has become infused and incorporated into the very essence of the spirit of the people." So early as the commencement of the thirteenth century the celebrity of France for the production of stained glass, goldsmiths' work, Limoges enamel, and ornaments in carved ivory, and of illuminated manuscripts, had become European. In the fifteenth century the industrial arts attained an almost unrivalled development; and under the patronage of Francis I. the union of the highest order of artistic ability with the mechanical skill and experience accumulated during many centuries, stamped with a peculiar and unmistakeable character of perfection many of the celebrated productions of the period of the *Renaissance*. The establishment of the silk trade at Lyons, the ancient proficiency of Paris and other towns in all other branches of weaving, the Gobelins tapestry, the carpets of the Savonnerie, the Sèvres China Institution, and the commencement of the employment of cotton, about the end of the seventeenth century, are all landmarks in the great scheme of French manufactures.

Under the first of the heads into which Mr. Wyatt has divided his report, viz., "the present exposition," much valuable information, as might be expected, is given. The first portion of it is directed to the building, which was erected in the Carré de Marigny, a piece of ground abutting on the main avenue of the Champs Elysées, a site offering every possible advantage, and the same which was occupied by the Palace of Industry in 1844. Plans are given by which at a glance the difference of the arrangement of the Palace of Industry in 1844 and that of 1849 is made apparent, and it is stated that the interior of the vast rectangular courtyard in the plan of 1844 must have presented a magnificent *coup d'œil*, which is totally wanting in its fellow of the present year.

After observing that both internally and externally there is a good deal of tasteless and unprofitable ornament, Mr. Wyatt states, on the authority of M. Audiganne (Chef de Bureau de l'Industrie), that the amount expended, so far as can yet be ascertained, has been 450,000 francs. The cost of the building in 1839 was 14,550*l.*; 1844, 15,050*l.*; 1849, 16000*l.*; adding 2,000*l.*, the cost of the agricultural shed; the whole sum expended this year is 18,000*l.* In these calculations, however, it must be remembered that the money is paid only for the hire of the materials for about three months, the whole remaining the property of the contractors at the termination of the exhibition. In 1839 the cost of the building was at the rate of 2s. 2d. per square foot, English; 1844, 1s. 3½d.; 1849, 1s. 2¾d. Setting aside the year 1839 as a manifest extravagance, it is ascertained that 1s. 3d. has been the average cost of building per foot square in the last two French expositions; but at the same time it is to be remarked, "that the work is done in an extravagant style, and that the expenses of some branches of building are considerably greater in France than in England."

In the first three expositions it appears no system of classification of products was adopted—an unfortunate omission, for, if the object be to instruct the public, "the clearness of their memories and impressions mainly depends upon the simplicity and perfection of the system of succession, subordination, and classification of all the elements composing the great display; if it be otherwise they gain only a confused sense of weariness, instead of a series of important, mutually dependent, practical conclusions." In 1806, the first attempt at arrangement was made by M. Costaz, who edited the report of the jury that year, and who proceeded on a geographical analysis, treating his examination of all the objects exhibited under the heads of the departments of France from which they emanated. In 1819, he again edited the report, and on that occa-

sion adopted an entirely material or natural system, dividing all the arts into 39 heads. The consequence was, of course, great confusion. In 1827, M. Payen took up a purely scientific arrangement; but this was deemed too artificial, and abstract; and in 1834 M. Dupin established his system of division on the basis of the relation of the arts to man. Thus the division was made into alimentary, sanitary, vestiary, domiciliary, locomotive, sensitive, intellectual, preparative, and social. This analysis was adhered to in 1839, and found to work very well. In 1844, the jury adopted a more material classification, uniting something of the spirit of each of the three former systems. They classified the manufacturing arts into eight divisions, styled "Arts on the Accidental, or Natural System; viz., woven; 2, mineral; 3, mechanical; 4, mathematical; 5, chemical; 6, fine; 7, ceramic; and 8, miscellaneous. This arrangement led rather to confusion; and in the present exposition, "in which this system (if any) has been followed, it is sufficiently complicated to render it extremely difficult to refer to any particular object, from its proximity to others not having any analogy with it. , ...

As to the nature and character of the products, it was a matter of common complaint amongst all interested in the present exhibition, that owing to the commercial crisis of 1848, it had become almost impossible to foresee either the probable amount or character of the goods forwarded for exhibition. The most careful computations, therefore, as to the relative spaces occupied by different trades would rather mislead than inform, if they were likely to be regarded as the slightest indications of what might be probable in England. On examining and comparing the leading features of all the previous expositions, we find that each one was especially characterised by some feature peculiarly its own :—

"Thus machinery, which this year is the great and predominating attraction, in 1839 was comparatively a minor item; while the products of Mulhausen, which in 1839 actually required a special great hall for themselves alone, this year sink into the ordinary space allotted to many other branches of industry. In quality of her position, as 'mistress of the reigning *mode*,' France this year, as in duty bound, exhibits a dazzling array of pretty and tasteful objects. Evidence is exhibited on all hands of the extent to which the education of her workmen has been carried. Scarcely ever do we recognize a piece of bad ornamental modelling; where the human figure is introduced, it is rarely ignorantly drawn. In the departments of manufacture requiring tender manipulation, such as the more delicate articles of jewellery, carving, tooling, &c., we recognize a practised hand, acting in unison with an ever-thoughtful head. Everything seems produced, to a certain extent, *con amore:* and on conversing with every tradesman, he will be found to take an immediate pride in his occupation, as a means of elevating him in the social scale, rather than as a drag to prevent his entering into competition with a class whose hopes, fears, associations, prejudices, virtues, and demerits have little natural affinity to his own. Thus, French manufacture has a certain peculiar charm, which frequently paralyzes the judgment in appreciating the numerous structural defects which her productions constantly exhibit. If a piece of furniture be well and artistically carved, the ordinary eye cares little whether it be or be not well fitted or well seasoned. A beautiful silver-gilt ornament is at once preferred to an ugly gold one, and a paper-hanging printed in two tints which harmonise, is far preferable to one executed with sixty, all of which 'fight' and weary the eye. The only important branches of manufacture in which, to judge from the present exposition, France seems decidedly behind England, are those of the application of mechanism to carving on a large scale, the manipulation of gutta percha, tin-plate and Britannia metal working, earthenware, and japanning on papier-maché, and generally, perhaps, in her immediate adaptation of new machinery to facilitate, and consequently cheapen, production; while in many departments—such, for instance, as the cultivation of the art of enamelling, of bronze-working, of the production of artistic stoneware, the making and colouring of terra cotta, and of riband and silk weaving and dyeing; she appears as decidedly in advance. In such a report as the present it would be needless to particularize the differences between the manufactures in detail; but it may, perhaps, be well to remind those interested, that the predominating feature of this year's exhibition in France is the manifestation of her power to get up those machines on the possession of which our facility in production has long depended, and that if once she attain in this department anything approaching our mechanical resources, at the same time retaining her present artistic capability, there is little doubt she will be enabled to command many markets to which we alone now procure access, and which we are too apt to regard as permanent property, rather than as requiring peculiar and continued exertion to monopolize."

Under the head "General Excellencies and Defects of the present Exposition," Mr. Wyatt notes, as the chief excellencies of the arrangements, "the extreme liberality with which the building has been constructed, and the noble style in which the whole affair has been managed as regards the unlimited supply of public money, the number and civility of the keepers and attendants, and the ease with which the enormous mass of visitors were enabled to circulate by the width and uninterrupted lines of the gangways." The present arrangement of the catalogue Mr. Wyatt considers defective, and he points out the advantages of allowing exhibitors to fit up their own stalls at their own expense, as it affords an opportunity for the exercise of individual taste, and at the same time effects a considerable saving of time, trouble, and expense to the Executive. The necessity of all goods being finally arranged some time prior to the opening of the exhibition is particularly dwelt upon. The non-observance of such a regulation completely marred for some time the effect of the exposition, and the better class of citizens and foreigners scarcely visited it for the first month.

In noticing the architecture of the building, Mr. Wyatt observes that one peculiarity most distressing was, that a system of sham seemed to preside over all the ornaments and constructions. "Great *carton pierre* trusses which supported nothing, painted bas-reliefs to imitate bronze, fir covered over with paper to make it look like oak, were all unnecessary and wasteful professional forgeries;" and he states his belief that a better building might be erected, affording the same area and advantages as the Parisian Palace of Industry, and avoiding its defects, for an amount less, probably, by one-fourth, than that which has been expended upon it.

The second division of the report, that which relates to the past expositions, gives a rapid and lively sketch of the origin of such institutions, and the leading features by which each successive exposition has been characterized. The first official exhibition took place under Napoleon, in 1798. On the same spot, in the Champ de Mars, on which the army had celebrated the inauguration of the noble collection of Italian spoils, and but six weeks after that *fête*, the nation erected the "Temple of Industry;" and exhibited specimens of the blessings and advantages of peace. The success of the first experiment led the Executive to determine to institute similar exhibitions annually, and letters were addressed to the prefects of the departments, requesting them to form local committees to examine and forward proper products to Paris at the public expense, and which might be eligible to carry away the prize of twenty silver medals offered by the Government, or one gold one to be awarded to whoever should have opposed the most formidable rivalry to English manufacture. Notwithstanding this circular, an interval of three years elapsed before the second exposition took place, when 220 exhibitors were admitted to the competition. It was on this occasion that the immortal Jacquard obtained a bronze medal, and subsequently a pension of 1,000*f.* per annum, which was ultimately increased to 6,000*f.* Mr. Wyatt mentions it as a gratifying circumstance, that it was in consequence of Jacquard's reading the advertisement of a premium offered by the Society of Arts, that he was induced to turn his attention to the study of that loom which has since rendered his fame so universal. The third exposition took place in 1802; the Société d'Encouragement was established immediately after it, but nothing worthy of special mention is recorded of the exhibition itself. In 1806 the fourth exposition was held, and, in the meantime, French industry had made extraordinary progress under the influence of the master-mind of Napoleon. In every department of textile fabric an amazing improvement had been effected; and the manufacture of iron, and steel, and porcelain was conducted on greatly-improved principles. The isolation which for many years separated manufacturing France from the other producing powers of Europe, by forcing her energies to supply alone what other countries derived from mutual co-operation, laid the foundation, Mr. Wyatt remarks, for that facility and universality of manufacture which so eminently distinguish her in the present day. It is partly owing to this state of continued exertion that in 1819, on the occasion of the fifth exposition, France is still found on the high road to honour and distinction. The leading features of this exhibition was the improvement which had been effected in the manufacture of metal work, and the superb and numerous specimens contributed. The exertions of Daniel Kœchlin, the Thomson of French calico-printing; of Raymond of Lyons, the inventor of the process for fixing Prussian blue in silk dyeing; and others, also marked the character of the period which had intervened. Jacquard reappears at this exhibition, gaining a prize more worthy of his great abilities; 360 medals of different kinds, and 17 crosses of the Legion of Honour, were given to 377 out of 1,662 competitors. The exposition of 1823 was attended by fewer contributors; but still progress was manifested in the products brought forward, and the exhibition was signalised by the appearance of the first suspension-bridge by Seguin, Freres. In 1827, when the seventh exposition took place, great improvements in the arrangement and classification of the various branches of industry were introduced by M. Payen, the learned chymist. The influence of the application of steam as a motive-power began now to make itself sensibly felt; and while in evenness and regularity of finish the goods contributed showed a manifest advance, the prices at which it was found possible to deliver them in the market greatly extended the home consumption, and laid the foundation for a considerable export trade. The manufacture of merino had enormously increased, 15,000,000*f.* worth being annually disposed of, while the shawl, silk, tulle, and blonde trades had also expanded in an equally magic manner. Vast improvements had taken place in the productions of silk; and the application of machinery to making paper in endless lengths, enabled the superior French taste in the matter of paper-hangings to rival, and ultimately monopolize, the favour with which, up to about this time, the English productions had been regarded. The brilliant re-

sults of the experiments of Vicat placed the scientific study of natural and artificial cements on a new footing; and improvements in plate-glass manufacture, and the revival of the processes of painting and staining that material, added another element to the resources of ecclesiastical decoration. The eighth exposition, that of 1834, showed a steady progression in almost every variety of manufacture in silk, cotton-printing, flax-spinning, in tools, and chymical productions of every kind especially. Among the novelties introduced may be mentioned paper-hangings printed from cylinders at Mulhausen, the revival of the arts of enamel and "niello," the re-creation of the art of wood-engraving, and great excellence in marqueterie and ornamental cabinet and inlaid work. The number of exhibitors amounted to 2,447, of whom 697 were rewarded with medals, 23 with decorations of the Legion of Honour, and the merits of 1,785 were recognized by the central jury, over which M. Dupin presided. The ninth exposition, in 1839, was accompanied by a declaration of the central jury, showing how much the French trade had increased, the growing demand on the part of the public for vast quantities of goods at the lowest price, and the adoption by manufacturers of the principle of "large sales and small profits." The declaration stated that the principal points regarded by the jury were—"1st, inventions and improvements, classed according to the importance of their results as affecting manufacture; 2nd, the extent of the factories, and their typographical situation; 3rd, the actual and commercial quality of the goods; 4th, cheapness attained by increased facilities of production." The adoption of this eminent popular business theory was mainly dependent on four causes,—1st, on the improvements effected in machines, substituting the mechanical for the human hand; 2nd, on the progress of popular education;—municipal libraries, communal and drawing schools, local museums, free exhibitions of works of art, and the liberal rewards and aid given to students, had for years been laying the foundation for that cultivation of the intelligence of the lower orders which in the present day has elevated the mind of the French artisan to nearly a par with that of the universal artist; 3rd, on a better comprehension of the theory of commercial as connected with political and social economy; and 4th, on the interest which these periodical exhibitions of industry, and the publication of admirable critiques upon them, had excited in the public mind. The exhibition of 1839 exhibited many features of interest and novelty. The jury dwelt with admiration on the native silk, and the native nitre, the marbles of the Pyrenees, the lithographic stones discovered in France, the introduction of stearine, the fine wool, and the various qualities of ironstone. The progress attained in different kinds of machinery, in the processes of manufacture of steel, glass of every description, and leather, were reported as remarkable, while, "in the dissemination of the elements of beauty through graphic representations, the arts of lithography and engraving on wood were allowed to have materially aided in popularizing fine art, and, by spreading abroad reproductions of models of form, to have assisted in adding the charm of elegant design to almost every department of industry susceptible of the happy combination of grace and utility." No less than 4,381 exhibitors contributed, of whom 878 gained rewards. The tenth exhibition, in 1844, was certainly, Mr. Wyatt observes, "the culminating point of the series, revealing the successful results of the influence of long-continued peace and peaceful government on the industry and producing powers of France. In every possible department of manufacture, from the most elaborate to the most simple, specimens of great beauty and utilitarian perfection manifested the ingenuity of a people cultivated by long study and habit in the highest degree to appreciate excellence as consumers, and at the same time fully equal to the task of supplying it as producers." Baron Thenard, president of the central jury, in addressing the King on this occasion, enumerated in succession a number of the most important points in which notable improvements had been made. He dwelt on the progress of steam navigation, distillation of salt water, on the perfection of iron casting, on the application of new systems of warming and ventilation, and of electro-metallurgy, on the manufacture of the best flint glass for astronomical purposes, of pyrolignous acid, of sulphate of soda, of muriate of potass, of artificial manures; of white lead, of sulphuric acid, of dyes and pigments, of silk and sugar; on the admirable arrangement of lighthouses; and on the increase in the supply, from national resources, of raw silk, of wool, sugar, and of flax; but most earnestly of all did he commend to his sovereign's attention, "the amazing advance which had been made in the construction, not only of machines, but of those mighty engines by which machines themselves are made—by which the stubborn iron is moulded to the will of man, with an ease of operation as far exceeding his uncertain efforts in regularity and precision, as in force and almost limitless power." In addition to these, in all those handicrafts which rise from the indus-

trial almost into the department of the fine arts—that in silver, and bronze working, in jewellery, ornamental modelling and designing, in every fabric and material, France in 1844 exhibited such a display as no other country could have possibly brought together; and the benefit, derivable to her citizens and to the world from an inspection of this gorgeous collection of her products, must have been one of the greatest it has ever been the happy privilege of any one country to bestow upon the industry and producing powers of the world at large. No fewer than 3,960 manufacturers exhibited, of whom the merits of as many as 3,255 were more or less recognized by the jury.

The general characteristics of the exposition of 1849 having been described under the first head, Mr. Wyatt does not here dwell further upon them, but merely indicates a few of those peculiarities which distinguished it from all preceding expositions. In the first place, it is the largest, the number of contributors amounting to 4,494 and the central jury 64. In the second place, it is the first at which live stock and agricultural produce has been admitted to compete for prizes.

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Mr. Wyatt expresses his regret that the admission of products from other countries, proposed by M. Buffet, was unfortunately rejected; but he finds some excuse for this short-sighted policy in the fact, that the manufacturers of France were still "smarting under the protracted misery of actual and threatening civil war, and the effects of sudden commercial stagnation."

The third and last of the sections into which the report is divided, refers to the official arrangements for carrying out an exposition every five years.

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As to the funds whence the money should be drawn to defray the expenses, it appears that in 1791 a law was passed, declaring—"that the profits arising from fees paid on the granting of patents should be appropriated to the encouragement of national industry;" and from that source a considerable portion of the necessary sum has been derived. Previous to 1834, it appears from a decree signed by Louis Philippe, granting a supplementary credit of 90,000 francs, that these profits had been allowed to accumulate until they had arrived at a sufficient amount to more than cover the whole expenses of the exposition of that year.

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Mr. Wyatt concludes his report by a reference to the pecuniary value of the medals, which is by no means great. In 1839, it amounted to 2,429*l*. 12s. only; and in 1844, to no more than 3,238*l*. The actual worth of the gold medal is but 500f. (20*l*.), that of the silver medal but 30f. (1*l*. 4s. 2d.) "The distribution," he adds, "always taking place in public, under circumstances of extraordinary *éclat*, the hand of the Sovereign conferring the medals, the publicity and the local reputation attendant on success make, to active and zealous manufacturers, the attainment of one of these distinctions the object of extraordinary efforts, of years of unremitting exertion, and the pride and glory of their existence as citizens."—*Abridged from the Times.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 14TH OF NOVEMBER, 1849.

ROBERT SUTCLIFFE, Idle, Bradford, York, cotton spinner. *For improvements in machinery for spinning cotton, silk, and other fibrous substances.* Patent dated May 8, 1849.

These improvements refer to certain modes of constructing and mounting flyers in spinning machines.

1. The first of these modes consists in slipping them over small steel spindles, screwed at the top ends, and securing them in position with nuts. Each spindle is supported, and free to revolve, in a central cavity in the top end of a stud, attached to a rail, and is prevented from jumping out by a collar screwed thereon. A rising and falling motion is communicated to the rail, as in the ordinary machines, while above it, is a fixed rail which supports a pulley connected to a tube slipped over the stud, and free to revolve thereon. The bobbin is passed over the tube, and made to rotate by a driving band passing round the pulley. The thread board is attached to the stud, so that it may partake of its rising and falling motion. The thread is passed through one of the eyes of the flyer, and attached to the bobbin previous to its being made to revolve. Or,

2. The flyer instead of being slipped over a spindle, which revolves in a stud, is made with a tube or socket whereby it is supported, and free to revolve on a collar cut for that purpose on the top of the stud, and retained in position by caps or pins.

Claims.—1. The application of flyers attached to spindles, supported by and revolving in studs in combination with caps, or pins, or any mechanical equivalent, to keep the spindles in their places in the studs.

2. The application of flyers made with holes or sockets, whereby they are supported and revolve on studs in combination with caps or pins, or any mechanical equivalent to keep the flyers in their places on the studs.

George Edmond Donisthorpe, and John Whitehead, of Leeds, manufacturers. *For improvements in preparing, combing, and hackling fibrous matters.* Patent dated May 8, 1849.

1. The patentees describe, first, an improved drawing machine which consists of two endless bands, placed one above the other, which revolve at certain regular intervals of time, and carry the fibrous material between another pair of endless bands, which revolve continuously at an increased velocity. Supposing the fibres to be about 6 inches long, then the first pair of bands are made to travel at a surface speed of one-eighth of an inch at each partial revolution, while, during the same space of time, the second pair are caused to move with a surface speed of from $\frac{50}{8}$ to $\frac{60}{8}$ of an inch; whereby the material will be drawn out in small quantities, which are received on a rotary brush, suitably supported at the delivery end of the second pair of bands.

2. A combing machine is next described: The fibrous material is urged by a pair of feed rollers between two brushes, when a portion of it is seized hold of by a comb, which being fixed on the end of a bent arm, supported inside the main cylinder, and worked by a cam, is caused to protrude beyond the circumference of the cylinder when it arrives opposite to it. The teeth of the comb are finer and shorter than usual, and between them the fibres are pushed down by the action of the top brush. As the cylinder revolves, the comb, moving at a slower pace, is gradually drawn within the circumference, by the continued action of the cam, and thereby caused to come in contact with a coarse comb fixed to the periphery of the cylinder, to which the fibrous material is transferred. Behind the fixed comb is a brush fixed on one end of a lever, the other end of which is acted on by a fixed cam, so as to come in contact with the ends of the fibres and give them support when they arrive in front of an endless band of combs, supported at the end of the machine opposite to the feed roller. The material is carried conjointly by the two combs for a short distance, and deposited, as they receded from each other, in a rotary comb, which conveys it to a pair of rollers, which deliver it in slivers.

3. The patentees describe, lastly, a hackling machine, which is constructed with a number of hackling surfaces, each succeeding one lower than the preceding, and with an inclined trough for guiding the strick of fibrous material, in order that the points of action may gradually penetrate deeper into it.

No claims are made in this specification, and it is left to the reader to judge for himself what is new and what is old in the "improvements" mentioned in the title. The specification is, therefore, not such a valid specification as the law requires.

Samuel Wilkes, Wednesbury Heath, Wolverhampton, brass-founder. *For improvements in the manufacture of knobs, handles, and spindles for the same, for doors, and other purposes, and improvements in locks.* Patent dated May 8, 1849.

Mr. Wilkes describes, and claims—1. A method of making the sand core for casting knobs in one piece (instead of in halves, and uniting them by some adhesive material), on a hollow perforated tube, to allow the air to escape, with the lower part supported on a guard, whereby it will be correctly held in the sand mould, and thereby obviate the necessity of the hole in the crown—as is at present the case; which hole has afterwards to be plugged and soldered. The crown is made with a nib, to facilitate its being held in the lathe during the process of turning; and the knobs may be cast in pairs, if desired.

2. A method of making recesses in three or more surfaces of the spindle, in order to obtain greater nicety of adjustment in respect to length.

3. A method of attaching a shield to the bolt of a lock, so that when it is double-locked from the inside, it shall cover the outside key-hole.

George Henry Dodge, Manchester, manufacturer. *For certain improvements in machinery for spinning and doubling cotton yarns and other fibrous materials, and in machinery or apparatus for winding, reeling, balling, and spooling such substances when spun.* Patent dated May 10, 1849.

Mr. Dodge describes, and claims,

1. A novel construction of clutch-wheel, having a flange with a single detent upon it, and its application to the production of a copping motion.

2. The application of a scroll cam, acted upon by the clutch-wheel, which communicates motion to a second scroll cam that transmits it, through a rack and pinion, to the scroll shaft, and thence, by means of scroll cams, chains, and their appurtenances, to the copping rail.

3. A method of causing the copping rail to make the upward traverse with an accelerated speed.

4. A mode of causing the copping rail to makes a sudden rise or lift when near the nose of the cop.

5. The throwing the clutch wheel out of action by means of a strap fork acting upon

a lever, which removes a click spring in order to prevent the machine stopping.

6. The application of a ratchet wheel to the balance wheel, for regulating the downward motion of the copping rail.

7. The application of worm wheel and sector, or quadrant, on the doffing shaft, to produce the doffing movement of the copping rail when required.

8. Diminishing the distance between the spindles of throstle machines, in order that the alternation of the copping and guide rails, in proportion to each other, may be regulated and governed.

9. The application of a waste roller.

10. A novel construction of flyer.

11. Maintaining the tension of yarns in machines for winding, reeling, balling, or spooling, by a metallic drum, or fetter, fixed to a hinge attached to the guide rail; an arrangement of guide wire near the nose of the cop, and a hinge socket, or sliding joint, in the foot of the spindle.

CHARLOTTE SMITH, wife of Jabez Smith, of Bedford. *For improvements in certain articles of wearing apparel.* Patent dated May 14, 1849.

Mrs. Smith describes,

1. Certain improvements in stays and corsets, by which they can be more easily and quickly fastened and unfastened, tightened or loosened, and may be also made to fit the person with the utmost exactness without injurious pressure on any part.

2. A half boot or covering for the foot and lower part of the leg, to which the patentee gives the name of "Soccopedes Elasticus," from its possessing greater adaptability to the natural varieties in the shape of the foot and leg than any covering for these parts heretofore in use. The peculiar features of this article are, that the top part is made of one piece of some looped fabric, with an edging or bordering of elastic braiding; and that the top part is widened by a peculiar operation towards the heel, and lowered in front.

3. An improvement in travelling coats, cloaks, wrappers, &c., which consists in incorporating with them a back-piece of air-tight cloth, which may be inflated at pleasure by the wearer.

4. The application of the method of widening at the heel (mentioned under the second head) to the manufacture of stockings and socks of all descriptions.

5. A new fabric for outer garments, called the "Piuma Cloth," which is manufactured from the course description of silk known in India by the name of Tusseh, or Tussar Silk, and is at once extremely light and perfectly water-repellent. And,

6. In certain improvements in gentlemen's coats.

SAMUEL ALLPORT, of Birmingham, gun-maker. *For a certain improved method of making or manufacturing a certain part or parts of looms used in weaving.* Patent dated May 14, 1849.

Claims.—1. The piercing of a number of sets of mail holes at one operation by means of the tools represented in figs. 1, 2, 3, 4, and 5.

2. The cutting out of a number of sets of mail holes at one operation by means of the tools represented in figs. 6, 7, 8, 9, and 10.

3. The piercing and cutting out of a number of mails at one operation by means of the tools represented in figs. 11, 12, 13, 14, 15, and 16.

4. The striking or bevelling a number of mails at one operation by means of the tools represented in figs. 17, 18, and 19.

And 5. The modes of securing the punches and beds used in the manufacture of mails in their respective holders.

We shall give a particular description of these different tools, with engravings, in our next

RECENT AMERICAN PATENT.

(From the *Franklin Journal.*)

FOR AN IMPROVEMENT IN THE PIANO-FORTE ACTION. *John H. Low.*

The patentee says,—"The improvements which I have made consist, first, in a peculiar construction of that end of the hammer lever in which the fulcrum or pivot is placed, so that when the hammer is at its greatest height, or in contact with the strings, the point where the power is communicated from the key-lever, and the fulcrum or pivot on which the hammer-lever turns, shall be in a horizontal line, or nearly so, in connection with an opening or notch between these two points, sufficient to admit the head of the jack or fly by which the power is communicated, allowing the jack or fly to work off by its own regular motion, produced by being firmly attached to the key-lever, and describing a circle, of which the fulcrum of the key-lever is the centre. Secondly, in forming a rest, to prevent the jack or fly from moving more than is necessary to allow the hammer to fall upon the back catch, thereby avoiding the noise that is sometimes produced by the rebounding of the fly upon the surface, where it should slide smoothly."

Claim.—"What I claim as combined together, and with the hammer and fly, is the projection and peculiar recess, with its abutment or block."

WEEKLY LIST OF NEW ENGLISH PATENTS.

Robert Parnall, of London, clothier, for a new instrument for facilitating the stitching or sewing of woven fabrics. November 13; six months.

James Chesterman, of the firm of Messrs. Cutts, Chesterman, and Beddington, of Sheffield, machinist, for improvements in carpenters' braces and other tools and instruments used for drilling and boring purposes. November 13; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for improvements in the manufacture of sugar. (Being a communication.) November 14; six months.

Louis Adolphe Duperrey, of 112, Faubourg du Temple, Paris, France, engineer, for certain improvements in machinery for producing figures in relievo. November 17; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in manufacturing leather. (Being a communication.) November 17; six months.

Charles Ludovic Augustin Meinig, of Hamburgh, now residing in London, merchant, for certain improved modes or methods of applying galvanism and magnetism to curative and sanatory purposes. (Being a communication.) November 17; six months.

Charles James Pownall, of Kensington, Middlesex, Esq., for a certain mode or method, or certain modes or methods of ascertaining or registering the number of persons entering in or upon passenger conveyances and passage ways, and the instrument and apparatus for effecting the same. November 17; six months.

George Edmond Donisthorpe, of Leeds, manufacturer, and James Milnes, of Bradford, both in the county of York, for improvements in apparatus used for stopping steam engines and other first movers. November 17; six months.

William Brindley, of Nelson-terrace, Twickenham, Middlesex, papier-maché manufacturer, for improvements in producing ornamental designs on papier-maché, and in preserving vegetable matters. November 17; six months.

William Buckwell, of the Artificial Granite Works, Battersea, Surrey, engineer, for improvements in manufacturing pipes and other structures artificially in moulds when using stone and other matters. November 17; six months.

Samuel Stocker, of High Holborn, Middlesex, hydraulic engineer, for improvements in the beer-engines, beer-measures, and tobacco-boxes used by publicans. November 17; six months.

Thomas Worsdell, of Birmingham, Warwick, manufacturer, for certain improvements in the manufacture of envelopes and cases, and in the tools and machinery used therein. November 17; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Nov. 8	2079	William Ford	Holles-street, Cavendish-square,	"The Lady's Winter Polka Jacket."
,,	2080	William Blenkiron	Wood-street, Cheapside	Fastening for shirt collar.
10	2081	Gabriel Davis	Boar-lane, Leeds	Mercurial, steam, and hydraulic pressure gauge.
12	2082	Edward Golding	Hurstbourne Priors, Andover-road, Hants	Rolling barley-chumper.
14	2083	Robert William Jerrard	Oxford-street	Washing apparatus.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1372.] SATURDAY, NOVEMBER 24, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

ALLPORT'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF WEAVERS' MAILS.

Fig. 1.

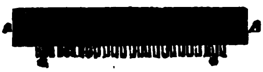


Fig. 3.

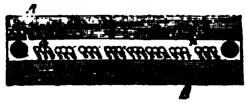


Fig. 4.

Fig. 2.

Fig. 10.

Fig. 1a.

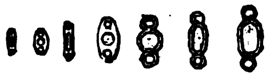


Fig. 5.

Fig. 7.

Fig. 6.

Fig. 8.

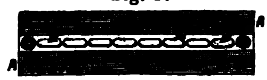


Fig. 9.

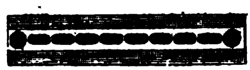


Fig. 13.

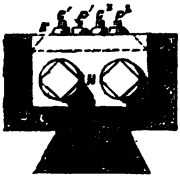


Fig. 11.

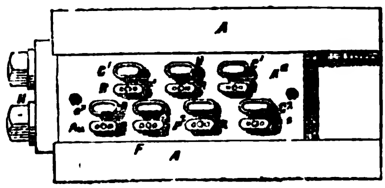


Fig. 16,

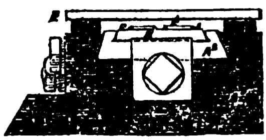


Fig. 14.

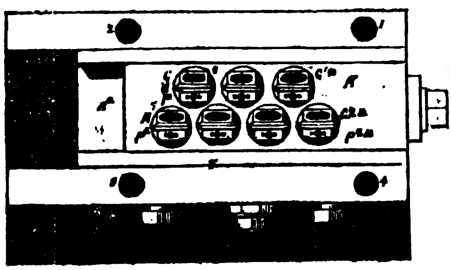
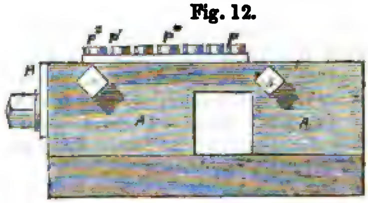


Fig. 12.



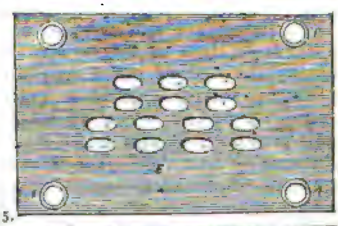


Fig. 22,

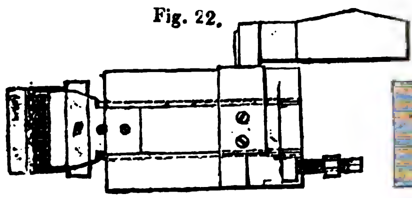
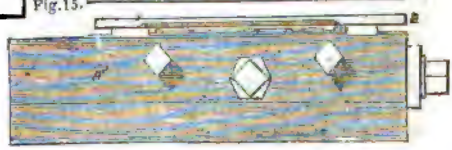


Fig.15.



MR. ALLPORT'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF WEAVERS' MAILS.

[Patent dated May 14, 1849. Specification enrolled November 14, 1849.]

We gave in our last the claims of Mr. Allport, and now proceed to extract from his specification the following details of his invention:—

"Weavers' Mails" are those small metallic substitutes for the treddle-eyes of the old plain weaving looms, which came into use along with the draw-loom and other figure-weaving looms of more recent date. As these mails are now made, the process consists of three principal operations:—First, a strip of malleable metal (copper, brass, or iron) is pierced at its extreme end with the number of holes suitable for a single mail—say three, four, or more—and these holes are produced by means of punches and corresponding beds fixed in and worked by a common fly-press, but only one set of holes is in this way pierced at a time, that is to say, by one stroke of the press. Second, the strip of metal, after it has been so pierced throughout, is passed between another set of tools, by which the mails, that is to say, small pieces of the metal, of an elongated oval (or any other required form), each embracing one of the sets of holes, is cut out and separated from the strip; but here, again, one mail only is cut out by each stroke of the press. And, Third, the detached pieces constituting each a mail in a rough state, are each separately subjected to what is technically called "a striking process," in order to bevel or round the outer rim of the mail, and also the edges of the inner holes. Plans of mails of different patterns, as thus completed, are given in fig. 1*.

Now, Mr. Allport's improvements consist, firstly, in piercing a number of sets of holes (instead of one set only) at one and the same time, or by one operation. Secondly, in cutting out a number of mails at one and the same time. Thirdly, in effecting by one operation both the piercing and cutting out of mails. Fourthly, in striking or bevelling the outer rims and interior holes of a number of mails (instead of those of one mail only) at one and the same time. And, fifthly (which is an improvement arising out of and consequent on the preceding improvements), in attaching the punches and beds to their holders, in such manner that on any of them breaking or wearing away, they can be replaced without having to cast the whole aside.

The new tools by which these improvements are effected are thus described:—

Fig. 1 is a side elevation, fig. 2 a cross section, and fig. 3 a top plan of the tool which I employ to pierce a number of sets of holes by one and the same operation. A, is the holder, and *a a* eight sets of punches, three in each set, which are inserted in the holder all on one line. The number of sets, and also the number of punches in each set, may be varied as may be required. At their upper ends they are slightly burred, as shown in fig. 2, to prevent their starting while at work; and the holders are countersunk to receive these burrs, so that they may come flush with the top face of the holder, A.

When any of these punches are broken or damaged, the holder, A, is detached from the bolster of the press or other machine used to work the tools, the faulty punch struck out, and a new one inserted in its place.

Fig. 4 is a top plan, and fig. 5 a section of a bed adapted to the piercing tool just described.

Fig. 6 is a side elevation; fig. 7, a cross section; and fig. 8 a top plan of the tool which I employ to cut out a number of mails at one and the same time. A is the holder, and *aa* the punches, which are burred at the upper ends like those of the tool first before described.

Fig. 9 is a top plan, and fig. 10 a cross section of a bed adapted to the cutting-out tool last described.

BB are two pins which project beyond the top surfaces of the two outermost of the row of piercing punches, fig. 6, and take into corresponding holes in the bed-plate, fig. 9, and thereby serve to keep the two tools in a perfect state of reciprocal adjustment while the strip of metal is passing through between them.

Fig. 11 is a top plan; fig. 12, a side elevation; and fig. 13, an end view of the tool by which I both pierce and cut out mails at one operation. A is a holder, and A* the punch-holder, which is slid into a recess in the upper face of the bed-piece, and bevelled at the sides to fit corresponding bevels in the sides of the recess (see fig. 13). H is a stop-piece, which is bolted to one end of the bed, A; P^1 P^2 are two rows of punches for piercing the mails; and C^1 C^2, two rows of punches for cutting them out—the piercing and cutting-out punches being placed in an alternating order. RR are seats raised on the face of the sliding holder, A*, and cut out of the solid metal of A*, into which the punches are inserted (from beneath), there being one seat for each set of mail holes, and

one for each cutting-out punch. The punches are burred at their upper ends exactly as in the single tools before described, and are removed and replaced when required in the same way.

Fig. 14 is a plan; fig. 15, a side elevation; and fig. 16 an end view of a set of beds adapted to the double tool last described. A^1 is a holder, which is slid dovetail-wise into a chase or carrier, A^2, which again is slid, also dovetail-wise, into a recess made for it in the upper surface of the foundation bolster, A^3. P^{1a} and P^{2a} are the beds corresponding to the piercing punches, P^1 and P^2; and C^{1a} C^{2a} are the beds corresponding to the cutting-out punches, C^1 and C^2. The beds are inserted into the holders in pairs, that is to say, each of the circular pieces, *cc*, contains one of the beds, P^{1a} or P^{2a}, and one of the beds, C^{1a} or C^{2a}. The pieces, *c*, are raised a little above the general surface of the holder, and each bed is separated from the other down to the depth of the projecting part, by a cleft, *d*. Each of the pieces, *c*, is also conically enlarged to a slight extent towards the bottom, which prevents its starting out of its place when in work, but enables it to be easily removed and replaced when the holder, A^1, is withdrawn from its chase and turned upside down. The piercing punches and cutting-out beds are so arranged in respect of one another, that the second sets of both shall come opposite the intervals between the first sets, whereby the amount of waste is greatly diminished, and room is obtained to give the requisite strength to all parts of the tools.

Fig. 20.

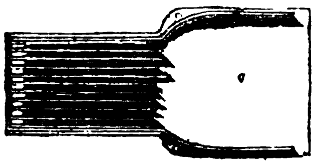


Fig. 21.

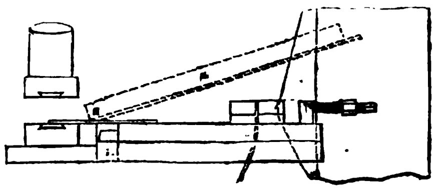


Fig. 19.

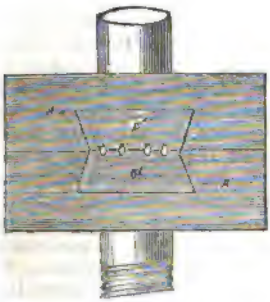


Fig. 16a.

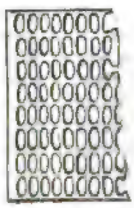


Fig. 17.

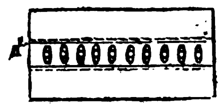
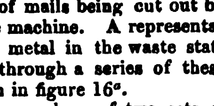


Fig. 18.



E is a plate called a "releaser," which has holes in it corresponding with the punches of fig. 12, and is secured by four bolts, 1, 2, 3, 4, to the under bolster when they are set to work, in order to prevent the strip of metal following the punches as they are withdrawn from the cutting out beds.

The double sets of punches and beds last described, being fixed in a machine in the usual way, with the sides, FF, in front, the strip of metal is introduced endwise between the beds and the releaser, and two sets of holes successively pierced in it by two strokes of the machine. The strip is next moved forward on to the top of the first row of cutting out beds, C^{1a}, and by a third stroke of the machine, the metal containing the first set of rows is cut out into as many mails as there are sets in that row. And so the work goes on continuously, a new row of holes, and a new series of mails being cut out by each stroke of the machine. A representation of a piece of metal in the waste state after it has gone through a series of these operations is given in figure 16a.

Fgs. 17 and 18 are plans of two sets of dies, D^1, D^2, by which I accomplish the "striking" or bevelling of a number of mails by one operation, and fig. 19, a cross section thereof on an enlarged scale. A A are the die holders. Each of the set, D^1, is an exact counterpart of the obverse side of one of the mails, and each of the set, D^2,

a counterpart of the reverse side, and the effect of striking a mail between them is to bevel or round both the outer rim, and the interior holes. The number of dies contained in the holders is represented in the engravings as ten, but that number may be increased or diminished as convenience may suggest. The machine for working these dies (as to which I claim nothing new), is provided as usual with a supply tray for containing the mails to be struck, and a feeder, by which they are delivered to the dies; but these appendages are made proportionately larger than usual, to suit the greater number of mails struck at one time, and the tray channelled also, in order to keep the mails separate in their passage to the dies. Fig. 20, is a plan of the supply-tray, Q. Fig. 21, is a side elevation of that part of the machine which includes the supply tray and feeder R, and fig. 22, a plan thereof. The tray, Q, is placed in an inclined position, so as to ensure by the downward gravitation of the mails a constant supply of them to the feeder, R, which delivers them to the dies.

The whole of the tools before described are proposed to be worked by steam.

MATHEMATICAL PERIODICALS.

(Continued from page 357.)

XVIII.—*The Diary Supplement.*

Origin.—The same year which witnessed the premature decease of *Burrow's Diary*, gave birth to the "Diary Supplement," the first number of which was issued under the title of "A Supplement to the *Ladies' Diary* for the year 1788." Dr. Hutton, the "Diary Author" of that period, appears to have been anxious to accommodate more of his correspondents, than the limited pages of the *Ladies' Diary* would permit, and hence he Sndertook "this Supplement at his own sole risk and expense, for the improvement of the *Diary*, and to oblige the more his learned and increasing contributors, by thus preserving a number of their ingenious compositions from being lost, from want of room to comprise them all in the narrow limits of the *Diary*; he (therefore) hopes all friends of that useful and amusing little work will extend the knowledge and *sale* of this Supplement as much as they can amongst their acquaintance." Notwithstanding the rather amusing admission at the close of this address, the worthy doctor's appeal does not appear to have been made in vain, for the pages of the Supplement soon presented a numerous list of correspondents, such as few periodicals can boast; but, like most works of this class, its existence was doomed to be brief, and it closed its career with the number for 1806.

Editor. — Charles Hutton, LL.D., F.R.S., &c., &c., Professor of Mathematics in the Royal Military Academy, Woolwich.

Contents.—The usual contents of each number are—Additional Answers to the Enigmas, Charades, Rebusses, Queries, and Mathematical Questions proposed in the *Ladies' Diary* for the preceding year; Account of Eclipses, Occultations, &c., for the current year; New Enigmas, Charades, Rebusses, Queries, and Mathematical Questions proposed for solution in the following Supplement; &c., &c.

The first number contains an "Alphabetical List of all the Enigmas, with their numbers," from the commencement of the Diary to the year 1774; and in the second number is given a table of "All the Transits of Mercury over the Sun for 300 Years," viz., from 1605 to 1894 inclusive. A list of all the solar eclipses visible in England between the years 1769 and 1999, "computed by Mr. William Chapman, and adapted to the town of Foxton in Leicestershire," was announced on the title-page of the Supplement for 1790, but was not printed until 1793: it contains the dates, beginning, middle, end, duration, and the digits obscured for each eclipse, and appears to have been the last miscellaneous dissertation published in this work. No mathematical papers were admitted into the publication, if we except an improved solution to Question 865 in the *Ladies' Diary* for 1788, by Mr. John Burrow. The original solution, however, appears to have been considered satisfactory by Professor Leybourn; for he has omitted to include the improved one in his edition of the *Diary*. Many of the enigmas, &c., are worthy of commendation, and amongst the queries are numerous interesting and valuable discussions, well worthy the attention of the inquiring student. The late Dr. Dalton. of Manchester (then Mr. John Dalton, of Kendal), was a frequent contributor to the philosophical department, and in it are

Mr. Dalton's coming greatness; for in the Supplement for 1794, after an explanation of the phenomenon of "periodical winds," the editor announces, that "this *ingenious* gentleman intends soon to publish a work entitled 'Meteorological Observations and Essays,' containing several new improvements, particularly relative to the Theory of the Variation of the Barometer, of Rain, of the Trade Winds, &c., together with a full discovery (as he apprehends) of the cause of the *Aurora Borealis*." This was Dr. Dalton's *first* publication, and was issued almost simultaneously with the *Diary* and supplement in 1793: it was the *avant courier* of numerous essays in the transactions of various learned societies, and the well-known "System of Chemical Philosophy," which, in connection with the Atonic Theory, gained their author a more than European celebrity, and raised him from comparative obscurity, to a high and honourable position in the world of science.

Questions.—The whole number of questions proposed and answered in the Supplement is 132, and a further selection of eight, was left unanswered on the discontinuance of the work. Besides these, each number contained several additional solutions to the questions in the *Ladies' Diary* for the current year; but, as the best of these have been incorporated with those given in the *Diary* itself, by Professor Leybourn in his edition, any further particulars respecting them are rendered unnecessary. The subjects of the questions embrace nearly the whole range of mathematical science as then understood, but since most of them are of a decidedly *practical* character, few points of interest present themselves; they would, no doubt, prove eminently useful to the teachers and students of that period, by furnishing them with a series of instructive examples for practice in numerical computation, and a selection might even now be made which would not by any means be without its utility. Dr. Gregory, Professor Leybourn, Colin Campbell, &c., were frequent and extensive contributors to this department: the last-named gentleman obtained the prize in 1794, and Dr. Gregory achieved the same honour in 1801. Question 15 corr11, where he asserts that tan. $30° +$ tan. $22\frac{1}{2}° =$ radius. Various analytical corrections are inserted in the next Supplement by Messrs. Burdon, Cook, and Haycock; and a geometrical construction determining two arcs having the stated property, is given by Mr. John Craggs, of Hilton, near Sunderland.

Ques. 27 gives the radii R and r of the earth and moon, and the distance d of their centres, to find a point in this line from which equal portions of the luminaries will be visible. Several general formulæ are given in the next number, and the question was afterwards re-proposed as No. 40 in the *Leeds Correspondent*, where an elegant geometrical construction may be seen by Mr. John Whitley, under the signature of "Geometricus," of Rotherham. Ques. 35 relates to that "very curious problem," "to divide a given circle into any proposed number of parts by equal lines, so that these parts shall be mutually equal both in area and perimeter." This question was first solved by Dr. Hutton, and was most probably suggested to him, when considering the kindred problem respecting the division of the "grindstone," which was proposed as Ques. 9 in the *Ladies' Diary* for 1709. Both these problems ere inserted by Professor Young in his "*Elements of Geometry*," and some interesting particulars respecting their history and discovery are inserted in his "Notes," on these propositions from the third volume of Dr. Hutton's Tracts, where the property is shown to hold when an ellipse is substituted for the circle.

Ques. 42 gives the same data as No. 27, and requires the point from which the visible surfaces are a maximum. Mr. Charles Brady solves the problem in the next Supplement and deduces the elegant property that "the *squares* of the distances (from the luminaries) are as the *cubes* of the radii."

Ques. 47 requires "the odds, at the game of whist, that the dealer holds all the thirteen trumps in his own hand;" it was proposed by "J. B., Esq.," (query Byerley?) and solutions are printed from Colin Campbell, Esq., and the Rev. J. Ewbank.

Ques. 87 is a numerical example adopted to Problem 54 of *Simpson's*

Messrs. Burdon and Gregory, both of whom refer to the original problem.

Ques. 127 requires the greatest octagon to be inscribed in a given square: various solutions are given. The next number, the last of which is a geometrical construction founded on a "remark to Prob. 59, p. 384, *Dr. Hutton's Montucla*," which determines the side of the octagon by bisecting the angle included between the diagonal of the square and the line joining the bisections of the opposite sides. Two other methods of determining the side may be seen in the solutions to Ques. 32 in No. II. of the "*Western Miscellany*," the first of which is the same as that given in *Elliott's* "*Geometry and Mensuration*," p. 61; and the second may be seen in *Leslie's Geometry*, Prop. XIV., p. 115, 4th edition.

Ques. 129 gives the area of a circle, and requires the length of a tether which, when fixed in the circumference, shall cut off a given portion of the area. The question was previously proposed as No. 170 in *Burrow's Diary* for 1788, but owing to the discontinuance of the work, no solution was published. It next appeared under a more general enunciation as Ques. 964 in the *Ladies' Diary* for 1793-4, to which a good solution was given by Mr. Buchanan, which included the question from *Burrow's Diary* as an example. The question was re-proposed in the Supplement, apparently to point out the advantages of applying the "Method of Double Position" to such inquiries; and two solutions are given to it on these principles by Messrs. Gittens and Wiseman. It was again re-proposed as Ques. 186 of the *Leeds Correspondent*, in consequence of an anonymous correspondent having asserted that the "*question could be solved without the assistance of Trial and Error*;" but the editor, Mr. John Whitley, after examining the proposer's solution, which was stated to be "done *pro forma*," could "not refrain from pronouncing it erroneous." Solutions by approximation were, however, given by Messrs. Johnson and Baines, and an elaborate calculation of a similar question is given by Mr. Davidson in his "*System of Mathematics*." From what has been stated, it will be concluded that the question has attracted much more attention than it really deserves, nor should we that similar questions are constantly "going the rounds" and form a sort of joint-stock *test* whereby the "knowing ones" in the provinces seek to prove the abilities of almost equally ignorant but more noisy pretenders.

Contributors.—Messrs. Adams, Barlow, Bearcroft, Bosworth, Brewer, Bruce, Burdon, Burrow, Campbell, Crosby, Dalton, Davis, Evans, Farey, Fildes, Furnax, Glendinning, Gregory, Hearding, Hellins, Holt, Howard, Leybourn, Lightbown, Lowry, Marrat, Mitchell, Nield, Pearson, Rowbottom, Rowe, Ryley, Scurr, Sewell, Smart, Squire, Surtees, Whiting, Woodhouse, &c., &c.

Publication.—The publication took place annually; some of the earlier Supplements have no printer's name attached, but the latter ones were mostly "printed for G. G. and J. Robinson, Paternoster-row, London."

THOMAS WILKINSON.

Burnley, Lancashire, Nov. 14, 1849.

Corrigendum.

Instead of the clause beginning with "but it did not," &c., col. 2, p. 422; insert the following, "it had previously been used by Mr. Lowry under the signature 'X. Y.,' in the solution to Ques. 224, in the *Companion* for 1812."

DAVIES'S PATENT ROTARY ENGINE.

Sir,—I have just observed in No. 1317 of the *Mechanics' Magazine*, a description of Mr. Isaiah Davies's Patent Rotary Engine.

You state, generally, that it has been very successful, and, amongst other points, notice "the preservation of the parallelism of the shaft, and the equable motion of the piston."

It further appears, in No. 1318, that Mr. Davies originally constructed his engine with a *single* revolving piston, which he has since changed to a double one, by which means "the steam is made to act on opposite sides of the shaft at one and the same time . . . . A further advantage is, that as the steam has a double area of piston surface to act upon, the power of the engine is considerably increased without any corresponding increase in its bulk and weight."

I must now draw your attention to the fact that, in 1845, I described a *double-revolving piston engine* (in the "Economy of the Marine Steam Engine"),

and enumerated its advantages in the same terms which I have quoted from your Magazine.

Mr. Davies's first patent was dated in 1844, and his subsequent patent for the double revolving piston was only dated in 1848.

In conclusion, I beg to say that I am gratified to find that my anticipations have been realized by the successful adoption, in Mr. Davies's engine, of the principles of construction which I was the first to publish, and have always considered of the highest importance. I am, of course, not aware whether Mr. Davies had read my work before he patented his engine.

Trusting that you will give insertion to the above, I am, Sir, yours, &c.,

W. H. Gordon,
Lieut. R. N.

Ellon Castle, Nov. 14, 1849.

PADWICK'S GARDEN DRILL.

(Registered under the Act for the Protection of Articles of Utility. William Frederick Padwick, of the Manor-House, Hayling Island, Southampton, Proprietor.)

Fig. 2.

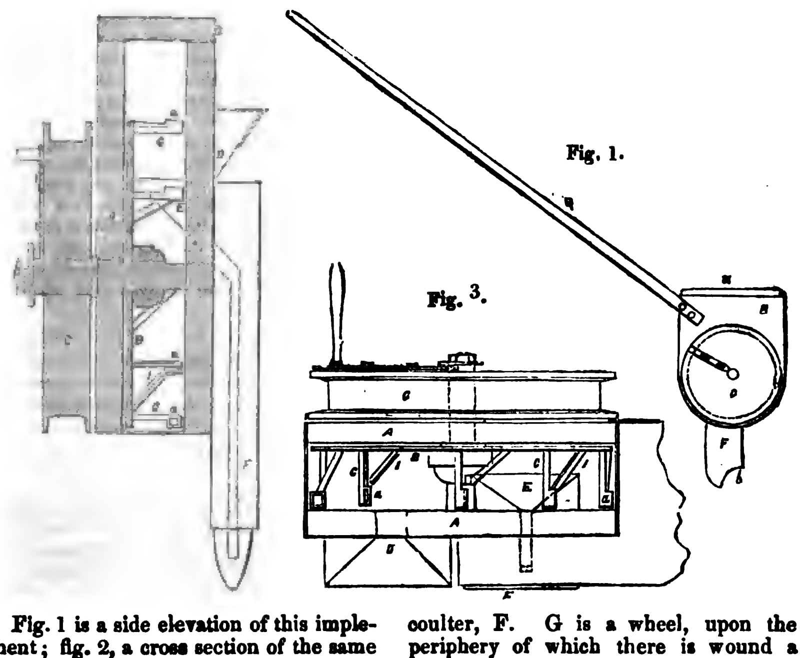


Fig. 1 is a side elevation of this implement; fig. 2, a cross section of the same on an enlarged scale, taken on the line *ab* of fig. 1; fig. 3 a plan of the seed-box, with the lid removed. A is a box or case, with a semicircular bottom; B, a disc, carrying a set of arms, CC, each of which is furnished at its outer end with a cup, *a*; D is an aperture by which the seed is introduced into the case; E is a hopper, into which the seed drops from the cups, *aa*, and from which it passes down through a pipe formed in the coulter, F. G is a wheel, upon the periphery of which there is wound a quantity of line.

In using the implement, the end of the line is attached to some point at the end of the bed to be drilled, and the implement is then drawn forward by the handle, H, which causes the disc to revolve, and the cups, C, to rise up and deposit the seed in the hopper of the coulter. I I are guides for conducting the seed into the cups.

DESCRIPTION OF A PLAN FOR VENTILATING COAL MINES BY MECHANICAL EXHAUSTION.

BY WM. BRUNTON, ESQ., C.E.

[We extract this description from a valuable pamphlet by Mr. Brunton, "On the Ventilation of Coal Mines," just published, (24 pp., 8vo., with plate, Nichols and Son); and very appropriately dedicated to Thomas Powell, Esq., of the Gear, Newport, "who at a season of extraordinary depression in the Coal Trade, generously incurred the expense of erecting the first Exhausting Ventilator with the view of testing its power of rarefaction, and making it publicly known." Mr. Brunton first describes in this pamphlet the ordinary means used to effect a rarefaction of the air in the upcast shaft of coal mines—namely, by a furnace or large open grate placed near to the shaft; next points out many insuperable objections to this system—its deficiency of power—liability to counteraction by changes in atmospheric pressure, &c.; and then proceeds as follows.]

I will now describe the mechanical means I have substituted, and the particular advantages it possesses over the furnace as a ventilator.

I construct over the upcast shaft, or over a chamber immediately connected therewith, a hollow drum, with curvilinear compartments, through which the air is discharged with that degree of force due to the velocity with which the drum revolves upon its axis. D, fig. 1, represents a drum, 22 feet exterior diameter, with curvilinear compartments: 16 feet being their mean diameter, the centrifugal force at 120 revolutions per minute will be 39·25, which, multiplied by the weight of 6 cubic feet of air $=\frac{444}{1000}$ of a pound, will give a pressure of 17·5 pounds on the square foot, as the amount of rarefaction produced in the interior of the drum, and consequently in the upcast shaft, A, with which it is connected, which is much beyond what can be obtained by the furnace, yet greatly within the limits of the capability of this machine, as shown below.

Figs. 1 and 2 represent an elevation and plan of it, connected by a short tunnel (T), with the pump shaft (R), as the upcast closed at the top by a strong cover with a hole through which the pump rod works; the machine is driven by a steam engine (S) sufficiently powerful to increase the rarefaction to meet and overcome any sudden or extraordinary influx of carburetted hydrogen. The amount of rarefaction is governed by the speed of the engine, and is also under constant and visible inspection by a water or mercurial gauge: thus when the drum revolves

				lbs.		
60	times per minute	the rarefaction	is	4·3	on square	foot.
90	,,	,,	,,	9·7	,,	,,
120	,,	,,	,,	17·3	,,	,,
150	,,	,,	,,	27·0	,,	,,
180	,,	,,	,,	39·0	,,	,,
210	,,	,,	,,	53·0	,,	,,

In order better to understand the peculiar self-adaptation of this apparatus to all the circumstances that present themselves in the practice fo ventilation of collieries, let us suppose it altogether unconnected with any length of air-course, the air from the atmosphere having free access to the centre, and space for free discharge from the circumference, and a velocity given to it of 150 revolutions per minute, creating a rarefaction of 27 lbs. per square foot in the middle of the drum; then the velocity of the air through the machine would be 108 ft. per second, and the aggregate amounting to 8424 cubic feet per second, or 505·440 per minute.

Then let us suppose a state the very reverse of the above, viz., that no air be permitted to enter the drum at the centre part, of course none can be discharged at the circumference; therefore, there being no resistance to the motion of the drum from discharge of air through the curvilinear compartments, but the power of the engine continuing the same, is consequently expended in increasing the velocity of the drum, and thereby the rarefaction. In the former case the effect is exhibited in the discharge of air; in the latter by the degree of rarefaction maintained in the middle of the drum.

From consideration of these two cases, it is manifest that the power required to work the machine will be as the quantity of air ascending the upcast shaft, and the amount of rarefaction required to draw it through the colliery; and such is the principle of self-adjustment of this apparatus, that if from any cause a less quantity or air is passed through the colliery at one time than

Fig. 1.

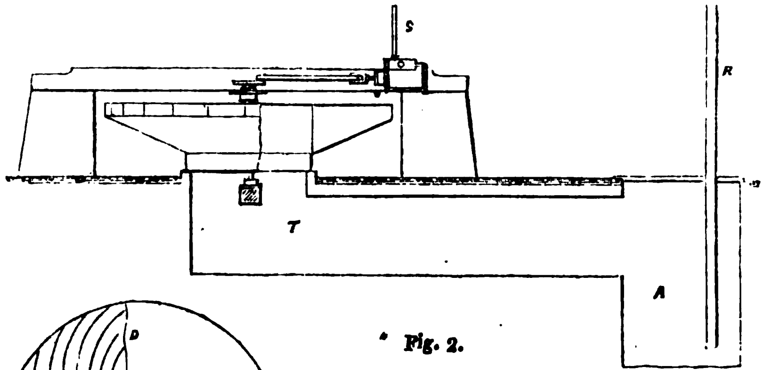
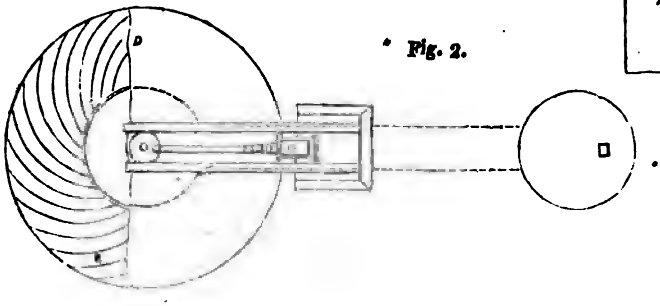


Fig. 2.



another, the engine (always exerting the same power) will of its own accord accelerate the velocity of the drum and increase the rarefaction, for the power applied being the same, the effect will be commensurate in the quantity of air discharged, the amount of rarefaction attained, or both combined.

The machine is an entirely new modification of the fan.* Its construction is of the most simple integral character; it has no valves or separate moving parts: has no attrition, and all the friction is resolved into a foot pivot moving in oil; when at rest offers no impediment to air ascending from the shaft, is very inexpensive, and liable to no derangement; in short, it is a simple mechanical implement, whereby any degree of rarefaction necessary to ventilation is rendered certain and regular, being subject to the law of central forces, which is as fixed and determinate as that by which a stone falls to the earth.

* We make no doubt whatever that Mr. Brunton honestly believes this apparatus to be as "entirely new" in its construction as his application of it to mining purposes unquestionably is, but if he will refer to our Journal for September 16th, 1848, he will find a description there given of an exhausting apparatus then recently patented by Mr. Lloyd, which, to our thinking, differs in no material respect from his own.—Ed. M. M.

In contracting it with the furnace, it may be further observed, that it is subject to no sensible difference upon the changes of the barometrical column, but, on the other hand, is capable by increase of velocity at such seasons of obviating or counteracting the danger connected therewith, and is equally applicable to all depths.

There will be no necessity for the separate conveyance of air by a stone drift into a higher part of the upcast shaft as practised to avoid the furnace.

All the injurious effect upon the iron in the upcast shaft will be entirely prevented, and no part of the workings need be stinted of air as to quantity.

By increasing the velocity of the machine during the absence of the workmen, the stagnation and danger referred to in page 13 would be prevented.

But beyond the ordinary requirements of ventilation, as now practised, there is an advantageous application of this machine, which can in no respect be effected or imitated by the furnace. It possesses such power of rarefaction that the atmosphere of a colliery may be subjected in half an hour to an artificial exhaustion of 3, 4, or 5 tenths of an inch of mercury, producing in the colliery, during the absence of the workmen

and their lights, the very same exudation of the gases that would have taken place during the natural change of the atmosphere indicated by a like fall of the barometrical column; and before the men re-enter the mine the machine will discharge the noxious gas by a current of fresh air more copious and effective than can be produced by any other means in use. All that is needful to effect this is, upon the retirement of the workmen and their lights, that the air be prevented entering the workings from the downcast shaft, the exhaustion alluded to will immediately commence; for, the quantity of air ascending the upcast shaft being decreased, the drum will be accelerated, and the whole extent of the workings will thus be subjected in a few minutes to the full measure of rarefaction obtained in the upcast shaft; upon the fresh air being permitted to enter, the colliery will be found in a state of extraordinary purity of atmosphere, and freedom from the risk of explosion.

It is the concurrent testimony of all intelligent underground men that the fire-damp exudes copiously during the fall of the barometer, and also that during its rise the reverse takes place; the fissures that during the fall were discharging gas, now absorbs or draws in atmospheric air; but the effects attendant upon a fall of the barometer must necessarily be more or less dangerous in proportion to the time it has been rising or nearly stationary, when a large portion of the gas evolved during that period will have accumulated in the goaf basins or vaults. The nature of this is so well described in the Report of Messrs. Lyell and Faraday, upon the explosion at the Haswell Colliery in 1844, that I have requested, and obtained permission to make the following extracts; but the whole of that document deserves the attentive perusal of every coal miner.

"The goaf may be considered as a heap of rocky fragments rising up into the vault or cavity from which it has fallen, perhaps nearly compact in the parts which are the oldest, lowest, and nearest the middle, but open in structure towards and near its surface, whether at the centre of the goaf or at the edges; and the vault or concavity of the goaf may be considered as an inverted basin, having its edge coincident with the roof of the mine all round the goaf.

"Let us now consider this goaf as a receptacle for gas, or fire-damp, a compound of hydrogen and carbon, known as light hydrocarbonate, and by other names. The weight of pure fire-damp is little more than half that of air; it gradually and spontaneously mixes with air, and the weight of any mixture is proportionate to the quantities of air and fire-damp. Any gas that may be evolved in the goaf, or that may gradually creep into it along the roof of the workings, against which it will naturally flow, will ascend into the goaf vault, and will find its place higher in proportion to its freedom from air; and this will go on continually, the goaf vault forming the natural basin into which all gas will drain (upwards) from parts inclining to the goaf, just as the concavity on the side of a gentle hill will receive water draining downwards from its sides, and from the parts above inclining towards it.

"Thus goafs are evidently in mines subject more or less to fire-damp, reservoirs of the gas, and explosive mixtures; giving out their gas into the workings of the mines by a gradual underflow in smaller or larger quantities under ordinary circumstances, or suddenly, and in great proportion, on extraordinary occasions; and they may either supply that explosive mixture which first takes fire, or they may add their magazine of fire-damp and explosive mixtures to increase the conflagration when the fire reaches them from an explosion in some other parts of the mine.

"There is one other point connected with what may be called the action of the goaf, and the occasional, sudden, and temporary discharge of gas from it. One of the witnesses on the inquest, Mr. G. Hunter, pointed out the effect he had observed in the mine on a change in the barometer,—that as the barometer fell fire-damp would tend to appear, and that it did this the more suddenly and abundantly if the barometer, having continued high for some time, fell suddenly; and Mr. Buddle has already strongly stated his opinion that accidents from fire-damp always occur with a low barometer.

"A fall of an inch in barometer, of a sudden, is rare, but a fall of one-tenth of an inch is not, and that in such a goaf as the one supposed, viz., 13 acres, would place 7,550 cubic feet below the edge of the cavity; this all tends to issue forth at one place, and that generally a place where the ventilation is weakest. Hence it does appear to us that the goaf, in connection with barometer changes, may in certain mines be productive of sudden evolutions of fire-damp and explosive mixtures, and that the indication of the barometer, and the consequent condition of the mine, ought to be very carefully attended to."

From these observations, it is obvious that if the fire-damp be drawn off at short intervals, as at every twenty-four hours, the accumulation and consequent danger will be very little compared with what it frequently is through the continuance of weeks of fine

weather; and the daily discharge of these minor accumulations will maintain the colliery, whilst the men are at work, in that state of safety (but better ascertained) experienced whilst the barometer is rising.

Possessing thus the power of anticipating the sudden exudation of gas by drawing it off when it can do no harm, and of rendering the colliery much more safe and healthy for the workmen, may we not reasonably hope that the subject will receive the attention it deserves, and that a system of alternate exhaustion and restoration will be judiciously brought into practice as experience will dictate, until the Davy lamp is no longer necessary for the common collier, the danger of explosion almost or altogether obviated, and the health of the miner greatly promoted.

THE LIGHT-LOAD, LIGHT-ENGINE SYSTEM OF RAILWAY TRANSIT.

[At the last General Meeting of the Institution of Mechanical Engineers (October 24), Mr. Samuel, the Resident Engineer of the Eastern Counties Railway, read a paper "On the Economy of Railway Transit," the object of which was to bring under the notice of the Meeting the advantages of the "Light-load, Light-engine System of Railway Transit," of which Mr. Samuel has the honour of being the originator (see *Mech. Mag.* vol. xlvii., p. 455). An abstract of the paper is given in an Official Report of the proceedings; but not of so complete a description, as the importance of the subject appears to us to have demanded; the more especially, as in the course of the remarks which followed the reading of the paper, Mr. Robert Stephenson, the President, threw the great weight of his authority into the scale, against the general applicability of Mr. Samuel's views, and Mr. Samuel having no "following" then and there, to back him up properly, his paper was left (as it were) to speak for itself. We have, therefore, applied to Mr. Samuel for a complete copy of his paper, which, by his kind compliance, we are now enabled to lay before our readers. We have the pleasure also of adding to it a statement, with which Mr. Samuel has favoured us, of some very remarkable achievements performed since the reading of the paper, by the London and Norwich express train, which is propelled by a light engine on Mr. Samuel's plan. While touching on this subject, we may take the opportunity of recommending to general attention a pamphlet recently published by Professor L. Gordon, Regius Professor of Civil Engineering at Glasgow, entitled "Railway Economy" (Simpkin and Co.), in which Mr. Samuel's views are advocated and enforced with a vigour and ability, which must go far to neutralize the opposition, which the new system is experiencing at the hands of the Big-Engine and Big-Engineer party.]

On the Economy of Railway Transit. By James Samuel, Esq., C.E.

In the course of professional duties as Resident-engineer of the Eastern Counties Railway, the writer was anxious to avoid the heavy expense, consequent on the use of a large locomotive and tender, while inspecting the way and works of the line; and as an experiment, he had a manumotive machine constructed with driving-wheels, six feet in diameter; but, although a speed of about twelve miles per hour was attained, the expense of human power was great, and the converting men into machines—travelling back as it were into barbarism—was no pleasing reflection.

It then became a question, whether it were practicable to construct a miniature locomotive. On consulting with Mr. Adams, of the Fairfield Works, Bow, who has paid great attention to this question, he undertook to construct one. As the speed proposed, was considerably less than that of the slowest trains, the object aimed at was to make it so light, that four men might lift it off the line in case of necessity.

A machine was therefore constructed at the Fairfield Works, of the following dimensions:

Cylinder, 3½ inches diameter, 6-inch stroke.

Wooden wheels, 3 feet 6 inches diameter.

Axles, 1⅜ inch diameter.

Distance between the wheels 4 ft. 6 in.

Diameter of trailing axle 1¼ inch.

Vertical tubular boiler 12 inches diameter, 4 feet high.

The engines were fitted with link motions, and all the newest improvements. The weight of the whole machine was about 7 cwt.

It was predicted by many that, though this engine was a pretty toy, it would not run for want of power; but it did run at the rate of 12 miles per hour, and was then taken into the factory, to be fitted with a larger boiler, and to have the frame length-

ened, for the purpose of steadiness. When again placed on the rails, the machine acquired a speed of 20 miles per hour, but the original axis being too small for the increased weight, the crank axle was strained in passing through the points, and the machine was taken back to be refitted with axles of a larger size. When again taken out of the shop, the machine was of the following proportions:—

Cylinder, 3½ inches diameter, 6 inches stroke.

Diameter of all four wheels, 3 feet 4 inches.

Boiler, 1 foot 7 inches diameter, 4 feet 3 inches in height.

Tubes, 1¼ inches diameter, 3ft. 3 in. long.

Total heating surface, 43½ feet long.

Distance from centre to centre of wheels, 9 feet 6 inches.

Tank, to contain 40 gallons of water; seats for 7 passengers.

[Mr. Samuel here exhibited engravings taken from Mr. Weale's new edition of "Tredgold on the Steam Engine," showing a plan, side elevation, and section of the "Express" Locomotive Carriage, as it was then called.]

The extreme steadiness of the engine when travelling at high speeds, was remarked by many who have had an opportunity of running on her; this was to be attributed principally to the lowness of the centre of gravity, the frame being suspended from the axles.

The engine has run altogether about 15,000 miles, and the consumption of coke has been about 3 lbs. per mile; but the construction of the boiler is not such as to give the most economical results, although extremely convenient for the small amount of space required.

The greatest speed attained by this engine on the level was 51 miles per hour, but of course she could not maintain it. The ordinary speed that might be safely calculated upon for a long journey, was 30 miles per hour: on one occasion, she performed the journey from London to Cambridge, a distance of 57½ miles, in 1¾ hours, with a consumption of coke 2⅔ lbs. per mile.

While the express engine just described was developing such satisfactory results, Mr. Adams and the writer had meanwhile been speculating on the desirability and applicability of steam carriages to the purpose of expresses, and also for working branch railways. After much consultation, the writer came to the conclusion that it was quite practicable, and an examination of the return, kept by the Company as to the traffic on the branch lines, showed him that the actual number conveyed by each train was under 50, the highest average being 47, and the lowest average being 10, and that the disproportion between the gross load of the train and the paying load, or the weight of the passengers, was enormous. In fact, it appeared from these returns, that the dead weight was to the paying weight as 24 is to 1, that is, 24 tons of engines and carrriages were employed to convey 1 ton of passengers!

It appeared to be this disproportion which, in large trains, necessitated the use of large engines (so large, indeed, that they defeat the very object for which they are constructed), because their extreme weight crushes the rails and the joints to such an extent that, practically, the railroad becomes a worse road, *quoad* the engines travelling on it, than an ordinary Macadamized road is to a stage-coach.

The object of the present paper is to show that the locomotives now in use on most of the railways have outgrown the wants of the passenger traffic, and that the weight on the driving wheels, amounting in some cases to 14 tons, is perfectly unnecessary for the number of passengers conveyed in ninety-nine cases out of a hundred.

The subjoined statement shows the actual number of passengers conveyed on the Eastern Counties Railway, both main line and branches, by each train for the week ending 7th May, 1849.

The Return shows the highest number in each train at any one time:—

CAMBRIDGE LINE.

Down Trains.		Up Trains.	
6· A.M.	141	10· A.M.	155
10· ..	55	1·25 P.M.	115
11·30 ..	98	4·20 ..	144
2·30 P.M.	166	6·25 ..	65
5· ..	217	11·0 ..	176
8·40 ..	61	4·26 A.M.	14

COLCHESTER LINE.

Down Trains.		Up Trains.	
8·10 A.M.	154	4·30 A.M.	7
11·0 ..	126	9·10 ..	111
3·30 P.M.	142	10·5 ..	138
4·20 ..	51	12·50 ..	139
5·30 ..	106	4·35 ..	134
6·30 ..	117	8· ..	35
8·30 ..	70	9·24 ..	172

HERTFORD BRANCH.

Down Trains.		Up Trains.	
9·0 A.M.	75	8·45 A.M.	148
10·15 ..	23	9·35 ..	144
10·30 ..	86	9·45 (Enfield)	84
3·55 P.M.	153	10·55 ..	115
4·30 ..	147	12·30 P.M.	139
5·15 (Enfield)	65	4·30 (Enfield)	25
5·45 ..	137	4·50 ..	107
7·30 ..	231	6·20 ..	113
9·0 ..	162	8·30 ..	135

WOOLWICH BRANCH.

Down Trains.		Up Trains.	
8.15 A.M.	20	8.50 A.M.	55
9.15 ..	27	9.50 ..	50
10.15 ..	41	10.50 ..	40
11.15 ..	35	11.50 ..	40
12.15 P.M.	55	12.50 P.M.	31
2.15 ..	62	2.50 ..	48
3.15 ..	43	3.50 ..	48
4.15 ..	57	4.50 ..	36
5.15 ..	73	5.50 ..	57
6.15 ..	54	6.50 ..	63
7.15 ..	55	7.50 ..	75
8.15 ..	82	8.50 ..	74

PETERBRO' BRANCH.

Down Trains.		Up Trians.	
Departure from Ely.		Arrival at Ely.	
10.20 A.M.	54	9.49 A.M.	11
2.25 ..	35	1.13 P.M.	50
6.10 ..	9	3.40 ..	35
8.30 ..	9	6.55 ..	36
11.35 ..	8	1.25 A.M.	3

MALDON BRANCH.

(From and to Witham.)

Down Trains.		Up Trains.	
8.30 A.M.	6	8.15 A.M.	11
50.10 ..	15	9.50 ..	8
12.35 P.M.	9	11. 0 ..	11
4.55 ..	11	4.35 P.M.	6
7.30 ..	13	7.20 ..	20

BRAINTREE BRANCH.

(From and to Witham.)

Down Trains.		Up Trains.	
8.30 A.M.	4	8.15 A.M.	15
10.10 ..	18	9.50 ..	8
12.35 P.M.	9	11. 0 ..	14
4.55 ..	16	4.35 P.M.	6
7.30 ..	20	7.20 ..	20

LOOP LINE.—CAMBRIDGE TO WISBEACH.

Down Trains.		Up Trains.	
9.29 A.M.	24	10.29 A.M.	20
1.43 P.M.	19	1.53 P.M.	19
7.48 ..	22	7.37 ..	32

	Down.	Up.
Average number of passengers per train between Norwich and Yarmouth	33	24
Ditto, between Reedham and Lowestoft..	24	23
Ditto, between Wymondham and Fakenham,	26	27

It would appear from this return that the greater number of passengers in any mail line train (exclusive of pleasure excursions) at any one time is 231, and the least number 7; the greatest number in any of the branch line trains being 82, and the least number 3. And by another return from the books of the Company, it appears that there were conveyed on the Eastern Counties lines during the year 1847, 42,644 tons of passengers, and that the weight of engines and carriages required to convey them was 1,112,570 tons.

On examining the coke returns, it also appears that the main-line engines consume from 24½ to 40½lbs. per mile; and the engines for working the branch-line trains, consumed from 16½ to 35½ lbs. per mile, varying, of course, with the size of the engine employed to do the work; the smallest engines invariably consuming the smallest quantity of fuel.

These returns refer to a stock of about 200 engines, and a length of line of nearly 310 miles.

Thus the writer came to the conclusion that it would be possible to construct a carriage and engine combined, of sufficient capacity for branch traffic; and, by his advice, the Directors of the Eastern Counties Railway gave orders to Mr. Adams to construct such a carriage, subject to the ap-

proval of Mr. Hunter, the locomotive superintendent.

The carriage was accordingly built, and called the "Enfield," from the branch she was intended to work.

The engine has 8 inches cylinder, and 12 inches stroke.

Driving wheels, 5 feet diameter.

Distance between centres, 20 feet.

Width of framing, 8 feet 6 inches.

The boiler of the ordinary locomotive construction, 5 feet long, by 2 feet 6 inches diameter.

The fire box is 2 feet 10½ inches by 2 feet 6 inches.

There are 115 tubes, of 1½ diameter, and 5 feet 3 inches in length, giving a total of feet heating surface in the tubes. The area of the fire-box is 25 feet, giving a total heating surface of 235 feet.

The weight of this steam carriage is 15 tons 7 cwt. when road-worthy. The engine and carriage being combined, it is evident that the weight on the driving wheels is increased by the load carried, and that the weight increases in the same ratio as the load required to be taken.

The extreme distance between the centres of the leading and trailing wheels, being 20 feet, accounts for the steadiness of this machine: there is, indeed, no perceptible oscillation when travelling at the highest speed; and this verifies the remark made by Mr. Stephenson and Mr. Brunell, on a former occasion, "that the steadiness of an engine depended not on the position of the driving wheels, but upon the length of the rectangle covered by the wheels."

The engine at the same time daily traverses curves of 5 and 6 chains radius.

The "Enfield" was originally intended to convey 84 passengers; but as it was found that, when she was put on as an express train, the passengers increased in number, a "North Woolwich" carriage was attached, capable of conveying 116 passengers, and also a "Guards' Break Van;" making provision *altogether for* 182 *passengers*, which is now her regular train, taken at a speed of 37 miles per hour.

The engine commenced her regular work about four months since, and has now run a distance of 14,021 miles.

The following return shows the actual running, the coke consumed while running, the coke consumed getting up steam, the coke consumed standing, and all particulars certified by Mr. Hunter, the locomotive superintendent:—

RETURN OF THE NUMBER OF MILES RUN AND COKE CONSUMED BY THE "ENFIELD" ENGINE, FROM JANUARY 13 TO JUNE 10.

Week ending.	Miles run.	Hours in steam.	Time running.		Time standing.		Coke Consumed. Getting up steam.	Running.			Standing.			Total Coke consumed.		U 3 p. Mile.	Oil.	Tallow.
1849.			H.	M.	H.	M.	Cwt.	T.	C.	Q.	T.	C.	Q.	T.	C.		Gls.	Lbs.
January 31	108	15	4	30	10	30	2		10	0		8	0		15	15·55	3	
February 11	612	105	31	30	73	30	14	1	18	0	1	1	0	8	13	18·47	6½	4
,, 18	186	15	4	30	10	30	2		13	0		3	0		18	10·83	½	
March 4	526	95	31	30	63	30	13	1	10	0		18	0	3	1	13·00	8	11
,, 11	556	97	33		64		13	2	1	2		18	2	3	13	14·70	6	5
,, 18	208	86	12	30	23	30	5		16	0		6	0	1	7	14·53	2	3
,, 25	562	98	34		64		13	1	13	0		18	0	3	4	12·75	4	4
April 1	688	105	34		71		14	2	10	2	1	0	2	4	5	13·69	3	4
,, 8	208	86	12	30	23	30	5		14	3		6	1	1	6	14·00	2	2
,, 15	698	105	35		70		14	2	9	0	1	0	0	4	3	13·31	5	3
,, 22	555	97	34		63		12	2	11	0		18	0	4	1	16·34	8	7
May 13	429	75	28		47		10		17	3		13	1	2	1	10·70	2	1
,, 20	592	105	35		70		13	1	13	2	1	0	2	3	7	12·67	5	1
,, 27	687	105	35		70		13	1	11	2	1	0	2	3	5	10·59	4	5
June 3	685	105	35		70		13	1	8	3		18	1	3	0	9·81	5	4
,, 10	585	100	30		70		13	1	6	3		17	1	2	17	10·91	3	2
,, 17	700	105	35	0	70		14	1	7	0	1	1	0	3	2	9·09	6½	7
,, 24	540	85	28	0	57		11	1	5	0		16	0	2	12	10·78	16	½
July 1	297	45	15	30	29	30	6		13	0		8	0	1	6	9·80	½	
,, 8	570	90	31	0	59		12		19	2		17	2	2	9	9·62	1	
,, 15	464	75	26	0	49		10		17	1		14	3	2	2	10·14		
,, 22	298	55	17	30	37	30	7		13	2		10	2	1	11	10·00		
,, 29	246	40	14	0	26		5		10	2		7	2	1	3	10·47	16	
August 5	547	85	28	0	57		11	1	1	0		16	0	2	8	9·80		
,, 12	368	55	17	0	38		7		14	2		10	2	1	12	9·73		
,, 19	520	80	28	0	52		10	1	0	2		15	2	2	6	9·90		
,, 26	424	70	26	0	44		10		16	2		13	2	2	0	10·56		
September 2	575	90	32	0	58		12		17	0		17	0	2	6	8·96		
,, 9	487	80	29	0	51		10		18	3		15	2	2	4	10·11		
Total	14,021													72	7	11·55		

The "Enfield" is in steam 15 hours per day; the fire being lighted at about six o'clock in the morning, and drawn at ten o'clock at night. But of these 15 hours she is engaged running only 5 hours, the remaining 10 being employed standing in the siding.

It was found by experiment that the quantity of coke consumed standing was 32lbs. per hour; and after deducting this, and the quantity consumed getting up steam, it appears that the actual consumption of coke running is under 6lbs. per mile.

On Thursday, the 14th June, this Enfield steam carriage worked the ten o'clock in the morning train to Ely, a distance of 72 miles, taking behind her three of the ordinary carriages, and two horse boxes: she arrived eight minutes before time; and the total consumption of fuel, including the getting up steam, was found to be 8¾lbs. per mile.

The tubes of the boiler are only 5 feet 3 inches in length, and the economy of fuel is scarcely at the maximum. Another engine, on a similar plan, to couple with a 40 feet carriage, is now nearly ready, the tubes being 6 feet 6 inches long, from which even more economical results are anticipated.

The result of the writer's experience is the conviction that, for express purposes, and by far the larger portion of the branch traffic on railways, the light steam carriage is the best adapted and most economical machine, both as to first cost compared to the work done, and in working expenses.

The repairs of the permanent way are also very much reduced, as may be easily imagined.

The philosophical analysis of the question appears to be as follows. Railways are constructed for the transit of passengers and goods. For the latter, which are capable of division into small parcels, some latitude of form and structure may be allowed. For the former, the stature and properties of man give a fixed standard. The carriages in which men are borne should be made lofty enough to permit of standing upright, when desired, for comfort to the rich, and for economy to the poor, as a larger number may be conveyed standing than sitting in a given space. The height being settled, the width must be so proportioned as to exceed the height by nearly one-third, in order to induce steadiness; bearing in mind that in a railway carriage there are two bases—the "spring base" of the frame on the axles, and the "wheel base" of the wheels on the rails. To secure a sufficiently wide spring base, the axles should be projected beyond the wheels; and in practice a body 10 feet wide may be obtained, where the width of the railway in centre and side spaces will permit. But this width being obtained, it becomes essential to get a proportionate length, to insure steadiness. Practice has verified this on the Eastern Counties Railway, where, for two years past, carriages 40 feet long and 9 feet wide, on 8 wheels, have been traversing the most difficult curves and gradients in England. The largest floor area per wheel, the minimum of dead weight compared with the load and the carriage, with least resistance to traction, is thus attained. The result of all is, that the minimum of steam power is required to draw it.

No truth is more certain than that the number of travellers by railway is increased by the facilities given for travelling. If a large engine and train cost a given sum, and the departures are every two hours, supposing that engine and train could be divided into four, and a departure take place every half-hour, at no increase of expense, it might be assumed that the passengers would double their numbers; but it may easily be demonstrated that the expense would be lessened, because by improved arrangement the total dead weight is much reduced.

On the Eastern Counties Railway an engine and tender of (say) 30 tons, a break van, a first-class carriage, and three third-class carriages, conveying (say) 120 passengers, make a total weight of 59 tons; and the consumption of coke, as has already been shown, is on the average 34lbs. per mile. A steam carriage weighing only 17 tons will transport the same number of passengers, at from 7lbs. to 8lbs. of coke per mile, when the best proportions are attained.

The first cost of a large engine, tender, and four carriages, has been 4000*l.* The steam carriage for the same number can be made for something less than half the cost.

The value of the railroad in lessening draught is in proportion to its approach to a perfectly horizontal level—not merely its general level, but its close approximation to the character of a lathe bed—a hard, inflexible, smooth, true, and equable surface.

With heavy engines, having 5 tons weight on each driving wheel, it is impracticable to maintain any road which it is possible to construct in this level condition; for, supposing the timbering to be of sufficient surface, and the rails to be perfectly inflexible girders, with their joints unyielding, the very iron itself will abrade beneath the tread of so heavily loaded driving wheels, which, whether of 8 feet or of 30 feet diameter, can only rest on a mere point. It is a matter of doubt whether more than 3 tons can be placed on a wheel at great speeds without destroying the metal.

But there is yet another question to consider. In order to start a train into motion,

a great amount of power is necessary, many times greater than that which is requisite to keep up the motion.

The surplus power remains in the train, under the name of momentum; and it must be obvious that the greater the total weight of the train, the greater must be the momentum. If the road be in bad condition, with loose joints, the momentum essential to the maintaining of motion is constantly absorbed by these concussions. In short, the joints are a series of holes; and many of our railways, relatively to the heavy engines traversing them, are practically worse roads than a well-made macadamized road is to a stage-coach.

If thus the weights be reduced below the point which causes destruction, it is probable that the heavy item called "maintenance of way," and the still heavier item of replacement of rails, chairs, and sleepers, will nearly disappear.

Remarks which followed the reading of the preceding paper, at the Meeting of the Institution of Mechanical Engineers, 24th October, 1849.

Mr. McConnell said, the results given by Mr. Samuel in his paper afforded proof of great economy; but how far this description of miniature engine might be brought into use on railways in general, must be determined by actual experience to a greater extent than was yet afforded. He believed that the branch on which the Enfield engine had been running was as favourable for the trial of the engine as any that could be selected. He had himself had an opportunity of travelling on the engine from London to Enfield, when the performance was very satisfactory for the load conveyed; but any increase of load or additional amount of traffic would materially affect the performance of the engine, because, with a just appreciation of economy, it had been balanced as nearly as possible to the load expected.

If they could in the general management of railways ascertain the exact number of carriages required for the accommodation of the traffic, a great economy of locomotive power might be effected; but unfortunately, in practice, they were often required to provide something like a maximum of power for a minimum of traffic. He had no doubt that the circumstances of many railways, particularly in those districts where the traffic was nearly uniform, would oblige them to adopt a power more nearly corresponding to their wants and to the loads they had to take; for undoubtedly the power of many engines at present at work very far exceeded their real requirements. He agreed with Mr. Samuel that this extra weight on the rails must materially affect the question of maintaining the permanent way; and as the quantity of coke consumed while standing and getting up the steam are expenses constantly attending all engines, he thought Mr. Samuel was quite justified in taking credit for economy. He was not, however, prepared to say how far this description of engine might be made applicable; but should be very glad to see any effectual step towards economy in the expenditure of railways, and he thought Mr. Samuel deserved great credit for having made such an effort.

As applicable to the subject, he recollected that on the Birmingham and Gloucester Railway it was found desirable to employ an economical power for the purpose of traffic on the small branch line from the main line to Tewkesbury, and for this purpose he adapted one of the small American engines, by combining the engine and tender on one frame, and by putting a tank on the top of the boiler. But the gradients ware very abrupt coming out from Tewkesbury, and when they worked the goods and passenger traffic together, they were frequently obliged to increase the number of carriages, and in some cases the power was insufficient. The engine had 10½-inch cylinders, with 4 feet driving wheels, and 20 inch stroke; the consumption of coke was from 15 to 17 lbs. per mile; and the gradients varied from 1 in 300 to 1 in 80. The pressure, however, on the American engines was very fallacious, for the spring balance only indicated about one-third of the actual pressure on the boiler, which was really about 100 lbs. per inch.

Mr. Adams, of Birmingham, remarked, that the Enfield engine was all on one frame with the carriage: but a different arrangement was adopted on the Cork and Bandon line, where the engine and carriage were on separate frames; and he inquired the reason for adopting the former plan in the Enfield?

Mr. Samuel explained, that as the length of coupling of the engine wheels in the Enfield was only 5 feet 4 inches, with an 8-inch cylinder, it was necessary to attach the carriage and engine on one frame, otherwise it would be too short to run steadily; the effect produced by the carriage was like the stick of a rocket in steadying the motion. But in the Cork and Bandon engine, with a 9-inch cylinder, the length of coupling of the wheels was 10 feet, and no carriage was required to produce steadiness, as the rectangle on the rails was so much longer. In the case of large engines, where the distance between the axles had been increased to 16 feet, a greater steadiness was observable.

There was accommodation in the carriage for 15 first class and 116 other passengers, giving a total accommodation for 131 passengers; and this he considered the most serviceable for working the express traffic.

Mr. McConnell said, his experience was, that in a long run, the small engines exhausted themselves, and were not able to keep up their steam if they had anything like a load.

Mr. Samuel said he had, with the Enfield engine, made the quickest journey that had ever been performed between Norwich and London. With a train capable of containing 84 passengers, they performed the distance of 126 miles in 3 hours 35 minutes, including stoppages. Another advantage in a large carriage of this description resulted from making use of the side space; for there were only 8 wheels to do the work of 24, and at the same time they had no greater amount of weight on each wheel than under the ordinary arrangement. The whole weight was 9 tons without passengers, and 84 passengers might be taken at an average as weighing 6 tons.

Mr. McConnell said, that undoubtedly, with the present carriages, the proportion of the tare to the passengers carried was very great; and although a case which rarely happened, instances had occurred where the tare was 50 tons to 3 tons of passengers. But even taking the weight of passengers at 10 tons, 50 tons of carriages was unquestionably a large proportion of dead weight to carry; and he considered that the long carriage, if always likely to be well employed, would be an advantageous mode of saving the dead weight, more especially on branch lines, and at the junctions where such branches came in.

The Chairman said, they were much indebted to Mr. Samuel for bringing the subject before them; and he only wished that more of their railway friends had attended the meeting, for it was a paper which well merited their deep consideration in the present depressed state of railway interests. The question of economy in the heavy current expenses of railways had for some time occupied his attention; and although he did not go to the full extent with the proposer of this new system, he nevertheless went to a considerable extent with him, and admitted that there were cases of passenger traffic, and branch traffic, and sometimes even short local lines, such as that from London to Greenwich, London to Blackwall, or London to Broxbourne, where the number of short passengers was great, and the number left in long trains was very small, thus causing the train after a certain portion of the journey to work very disadvantageously. He had no doubt that companies would have to classify these trains to a much greater extent than had hitherto been done, and in that case the present plan might be tried with advantage; but he could not go with Mr. Samuel in saying that an engine so light as he had described was applicable to express travelling.

Even the principle of attaching a carriage to the engine for the purpose of giving adhesion, appeared to him a very doubtful expedient, because small engines were much heavier in proportion to their power than large ones. He considered that Mr. Samuel's arrangement in the case of the Cork and Bandon engine was a good one, but attaching a carriage to an engine was very objectionable; it was like riveting harness to a horse, and could not be desirable under any circumstances whatever. Mr. Samuel did so to increase the weight on his driving wheels, and consequently obtain more adhesion; but he forgot that he had already more weight on the driving wheels than was adequate to drag the carriage along. This was adding more than enough, because an engine that weighs only 5 tons is not so capable of slipping upon the rail as an engine that weighs 30 tons; and therefore attaching a carriage upon the frame of a small engine was superfluous, and the inconvenience arising from having them riveted together would in some cases be exceedingly great, more especially in working a station.

Cases, however, might presently arise which would be favourable to the developement of the proposed system; for instance, railways had been laid down where hardly any justification existed for their construction; these must be worked at the least possible cost, and Mr. Samuel's plan might be adopted advantageously; but let not his very useful system be overstrained, because there was no great branch line, express or otherwise, to which it could by possibility be applicable. It would be largely applicable to minor branch lines, but he (the chairman) felt that if he were to allow this paper to be read without saying anything, considering the position which he occupied in the railway world, it would be taken as a tacit acquiescence on his part in the broad principle of applying small engines where, in fact, for a period of nearly twenty years (ever since 1831), they had been doing everything in an opposite direction to that which Mr. Samuel was now pursuing. Hitherto they had been contriving engines to develope railway traffic on the main trunk lines, where not only great dispatch, but great comfort, is exacted; and he would ask whether the public would be satisfied to be packed up like fish, ninety in a carriage? That they would not be content with inferior accommodation was sufficiently evident from the eagerness with which, on the arrival at a station, persons made their way to the four inside carriages, which he thought were much more conducive to comfort than the broad gauge carriages with eight inside.

— — - - remarked, that in his car. better accommodation than afforded by the present system, as not only were they 9 feet wide, but high enough for the tallest passengers to stand upright if they felt disposed.

The CHAIRMAN did not think that the loftiness of the carriage removed the objection, because it was quite possible for a crowd to be very closely packed.

Mr. SAMUEL replied, that he allowed the same floor area for each passenger as in the present system.

London and Norwich Express Train.

The engine which now works this train is called "The Cambridge," and is that referred to in the preceding paper as being in progress of construction, and likely to furnish more economical results than any previously realised.

The total average weight is as follows:

	Tons.	cwt.	qrs.	lbs.
"Cambridge" Engine, with coke and water . .	9	11	3	8
Patent eight-wheeled carriage, with tank underneath full of water . .	11	10	0	0
Six-wheeled first-class do.	5	10	0	0
Four-wheeled break van .	3	15	0	0
Total	30	6	3	8

This train affords ample accommodation for 140 passengers, and the total cost has been 2450*l.*, *which is very little more than the cost of a large engine and tender alone.*

The first trip made by the train was on the morning of the 1st instant; and the following is an exact statement of its performances:—

Distance from Station to Station.		Arrival.	Departure.	Time Occupied Running.	Speed between Stations.
		h. m. s.	h. m. s.	h. m. s.	Miles per Hour.
	Norwich	....	10 30 0	....	....
¾	Prowse-bridge	....	10 32 30	0 2 30	18
⅛	Do. Sation	....	10 34 30	0 2 0	3.75
5½	Hestursett, Bandtop	....	10 46 30	0 12 0	27.50
4	Wymondham	10 51 30	10 55 0	0 5 0	48
2½	Spooner-row	....	11 1 0	0 6 0	25
3	Attleboro'.............	....	11 6 0	0 5 0	36
3¾	Eccles-road	....	11 11 30	0 5 30	40.90
3⅛	Harling-road	....	11 16 0	0 4 30	41.33
7⅞	Thetford	11 27 30	11 34 30	0 11 30	41.08
7	Brandon	11 47 30	11 50 30	0 13 0	32.30
3¾	Lakenheath	....	11 58 30	0 8 0	28.12
5¼	Widdenhall	....	12 7 15	0 8 45	36.70
7	Ely	12 18 45	12 22 0	0 11 30	36.55
14¾	Cambridge	12 51 0	1 3 5	0 29 0	30.51
10	Chesterford	1 25 0	1 26 30	0 21 55	27.3
4	Audley End	....	1 37 0	0 10 30	22.85
6	Elsenham	....	1 48 0	0 11 0	32.72
5¼	Bishops Stortford........	1 56 0	2 3 30	0 8 0	39.37
6	Harlow	....	2 14 30	0 11 0	32.72
4¼	Roydon...............	....	2 19 30	0 5 0	51
3	Broxbourne	....	2 23 30	0 4 0	45
4¼	Waltham	....	2 29 30	0 6 0	42.50
3	Ponder's End	....	2 34 0	0 4 30	40. 0
2¼	Edmonton.............	....	2 37 30	0 3 30	38.58
1¾	Tottenham	....	2 39 45	0 2 15	46.66
2	Lea-bridge	....	2 42 30	0 2 45	43.63
2	Stratford	2 46 30	2 49 30	0 4 0	30
1¼	Bow.................	....	2 53 30	0 4 0	18.75
a 2½	London	2 58 30	....	0 5 0	30
126		Actual Running		3 47 40	33.20
		Including Stoppages..		4 28 30	28.15

The total consumption of coke for this trip was only 11½ cwt., being less than 10 lbs. per mile for the entire distance of 126 miles.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING NOVEMBER 2[illegible], 1849.

WILLIAM PHILLIPS, [illegible], Dime-street, London, gentleman. *For improvements in the construction of pianofortes.* Patent dated May 15, 1849.

The patentee describes and claims,—

The application of weights or pressure to pianofortes, either indirectly to the bridge, or directly to the sounding board itself, by whatever means may be found most convenient, so as to change the tone of the instrument, and thereby increase its musical capabilities.

LOUIS ALFRED DE CHATEAUVILLARD, Rue St. Lazare, Paris, gentleman. *For improvements in fire-arms, cartridges, bullets, bayonets, and ordnance.* (A communication.) Patent dated May 15, 1849.

These improvements, so far as they relate to "fire-arms," appear to have reference to a system of loading at the breech, known in France as "Montigny's system;" but the specification being, to all appearance, a literal translation in bad English of a bad French original, and several drawings being wanting which are alluded to in the specification, while those that are enrolled are referred to indiscriminately, we cannot take upon ourselves to say what the improvements really are.

As for the improvements in "cartridges, bullets, and ordnance," we can discover no trace of them, save in the title of the patent.

JOHN THOM, Ardwick, Manchester. *For improvements in cleansing, scouring, or bleaching silk, woollen, cotton, and other woven fabrics and yarns, and in ageing fabrics and yarns when printed.* Patent dated May 15, 1849.

1. The patent describes and claims certain methods of cleansing, scouring, or bleaching the fabric or yarn, by causing it to pass up and down over two series of rollers, supported one beneath the other in a suitable chamber filled with sulphurous acid gas or chlorine.

2. Of "ageing" the fabric or yarn by causing it to pass in a similar manner through a chamber containing aqueous vapour.

HENRY BESSEMER, Baxter-house, Old St. Pancras-road, engineer, and JOHN SHARP CROMARTIE HEYWOOD, Islington, Middlesex. *For improvements in expressing and treating oils, and in the manufacture of varnishes, pigments, and paints.* Patent dated May 15, 1849.

Claims.—1. Expressing oils or oleaginous substances, by forcing the matters to be operated upon, by means of a piston or plunger, in and through a pervious vessel, the resistance offered by which to the passage of the matters containing the oil will cause it to be expressed therefrom. (On the same p[illegible] juice expressing apparatus of Mr. Bessemer, described *ante*, p. 385).

2. Subjecting the matters containing oil to the action of pressure in water, so as to cause the oil to combine for a time with the water, and thereby facilitate its expression from the matters in which it is contained.

3. The application of a metal bath or air bath in the manufacture of varnishes and in boiling oils.

4. A method of withdrawing and condensing the vapours arising in the manufacture of varnishes and boiling of oils.

5. The use of phosphate of lime and oxide of tin in the manufacture of paints and pigments from vitreous materials, for the purpose of giving greater body and opacity to the colour.

6. The devitrification of the materials used in the manufacture of paints and pigments, for the purpose of obtaining body and opacity.

7. A mode of giving motion to the grinding surfaces used in the manufacture of colours.

MOSES POOLE, London, gentleman. *For improvements in apparatus for drawing fluids from the human or animal body.* Patent dated May 15, 1849.

An improved scarifier is first described which consists of a circular cutter, supported in an axis passed through a pulley around which a piece of twine is passed two or three times; and the whole is inclosed in an outer case, with two holes, through which the two ends of the twine are passed. The incission is effected by placing the cutter on the part of the body to be operated upon, and communicating a rotary motion to it by pulling one end of the cord. The depth to which the cutter is to penetrate is regulated by means of a set screw, or a guard screwed into the end of the case through which the cutter passes. In scarifiers of a larger kind it is proposed to adapt a shield to the end of the case with projecting points here and there, which have the effect of depressing the flesh out of the way of the cutters, so that the incision is a circular succession of cuts.

An apparatus is next described for withdrawing the blood, fluid, or milk. It consists of a glass cylinder, closed at one end, and containing a piston of the same material, which is made air-tight by a packing of cork or other suitable substance. The piston passes through the cap of the cylinder, and is tapped with a male screw, which gears into an interior screw tapped in the centre of a cross-rod. When the open end of the cylinder is placed over the incision, or nipple, the cross-rod is turned round so

as to raise the piston and create a partial vacuum beneath, which facilitates the withdrawal of blood, fluid, or milk.

Claims.—1. The improved scarifier.

2. The improved apparatus for creating a partial vacuum to facilitate the withdrawal of blood, fluid, or milk.

RECENT AMERICAN PATENTS.

(From the *Franklin Journal.*)

FOR A MACHINE FOR FORMING, BY COMPRESSION, PRISMATE HEADS ON METALLIC BOLTS. *William Grant.*

Claim.—"What I claim as my invention, is the formation of heads on bolts by machinery, by first upsetting or compressing into a partially closed die a portion of the rod, by means of a punch, into a shape approximating to the form required, but of larger diameter and proportionately shorter, and then by entirely closing the dies, and again forcing up the punch, reducing it to its proper proportions, and completing its form, whether the devices by which the several motions are produced be such as are herein described, or others capable of effecting the same results."

FOR AN IMPROVEMENT IN THE METHOD OF PRESERVING THE SHAPE OF STEEL SPRINGS IN THE PROCESS OF TEMPERING THEM. *David M. Smith.*

Claim.—What I claim, and as particularly applicable to the manufacture of curved flat springs, for trusses or for various other articles, is; 1st, the process, consisting of hardening the spring in the usual manner, when off the mould; 2nd, in drawing the temper (it being still off the mould), to such extent as to enable me to apply it to the mould without danger of breaking it while so doing; 3rd, in clamping said spring to a mould, and plunging it and the mould, so clamped together, into a bath of melted lead, or other suitable metal, or material or materials, in a fluid state, and raised to the temperature necessary to produce the desired effect of preserving the shape of the spring, or that given to it by the mould.

FOR AN IMPROVED PIANOFORTE ACTION. *John J. Wise.*

Claim.—What I claim as my invention is; 1st, the application of springs attached to a moveable bar or rail to the key-levers of the pianoforte, so as to impres different degrees of force; 2nd, I also claim the combination and arrangement of the turning rail, lever, and notched plate, for the purpose of graduating the force of the springs on the key-levers, in order to adjust the keys for various degrees of touch, and to the physical capacity of the performer, and to the character of the music to be played. I likewise claim as my invention, attaching the "*check*" to the "*under hammer*" (instead of the end of the key-lever, or to an additional lever), by extending the "*under hammer*" beyond the "*main hammer*," so as to receive the "*check-piece*," which I attach to it in any convenient way, by which arrangement the reaction of the main hammer upon the key-lever is prevented.

FOR AN IMPROVEMENT IN REFRIGERATORS. *Nathaniel Waterman.*

The patentee says,—The nature of my improvement consists; 1st, In ventilating the refrigerator through its top or lid. 2nd, In making the top a close hollow box or chamber, to be filled with atmospheric air only, instead of having two lids, viz., an inner and an outer one, as refrigerators are usually constructed. 3rd, In employing uncirculating or confined air, as the non-conducting agent or medium between the inner and outer cases of the refrigerator, instead of charcoal or other stuffing, such as has been commonly used. 4th, In a peculiar valve or contrivance for letting off the waste water and fluid matters which may be discharged from the ice, or any meats or articles placed within the refrigerator.

Claim.—What I claim as my invention is, 1st, The arrangement of the ventilating apparatus or register, in the lid or at the top of the chamber, as set forth.

2nd, The peculiar capillary valve cesspool, as constructed with the circular shallow groove in the seat plate, and its counterpart on the flap, and made to operate in the manner and for the purposes set forth.

NOTES AND NOTICES.

Steam v. *Ice.*—Captain Sir James Ross, in his Official Report of the proceedings of H.M. ships *Enterprise* and *Investigator*, in their late fruitless search after Sir John Franklin, says:—"I had much satisfaction the next morning to find how perfectly our steam launch fulfilled our expectations in an experimental cruise about the harbour (Leopold) before proceeding in her to the westward in search of a harbour for the *Enterprise*, as it was now beyond probability, from the early setting in of winter and from the unbroken state of the ice, to reach Melville Island this season. The pack at the harbour's mouth, however, still prevented our immediate departure, and all our energies were devoted to landing a good supply of provisions upon Whaler Point. In this service the steam launch proved of infinite value, conveying a large cargo herself, and towing two deeply-laden cutters, at the rate of four or five knots, through the sheet of ice which now covered the harbour, and which no boat unaided by steam could have penetrated beyond her own length."

Extraordinary Dispatch.—A coil of copper wire, 12,200 feet long, was delivered at the Gutta Percha Company's Works, City-road, at 4 p.m. on Monday, the 19th, to be covered with sulphuretted gutta percha for the Prussian Government, with strict injunction that it must be dispatched by the Hamburgh mail on the following day. Notwithstanding this short notice, the extraordinary feat was accomplished, the coil being shipped within 24 hours after its arrival.

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Webster Hancock, of Melbourne, Derby, manufacturer, for improvements in the manufacture of hosiery goods, or articles composed of knitted fabrics. November 17; six months.

Charles Edouard François Constant Prospere De Changy, of Brussels, now residing in Tavistock-street, Westminster, civil engineer, for improvements in the preparation and manufacture of flax, hemp, and other like fibrous substances. November 20; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, for certain improvements in the manufacture of sugar. (Being a communication.) November 20; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Nov. 16	2084	William Leachallas	Budge-row	Metallic lock envelope.
17	2085	Lutge and Co.	King Edward-street	Attachment or connection between the linings and fur portions of lined fur articles.
,,	2086	Thomas Frederick Hale	Bristol	Plunge-cock.
19	2087	William Macbay	Woolwich, Quarter-Master Sergeant, Royal Artillery	Mercantile fountain-pen.
20	2088	William Naylor	James-stret, Oxford-street	Glass ventilator for window-sashes.
21	2089	Charles Macintosh and Company	Manchester	Buckle.
,,	2090	John Elce and Co.	Phœnix Iron Works, Manchester	Dynamometer.
,,	2091	Thomas Kitson Potter,	Huddersfield	Victoria spirit lamp.
,,	2092	Samuel Butler and Co.,	Birmingham	Revolving heel for boots, shoes, and clogs.

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

FONTAINEMOREAU'S PATENT JACQUARD LOOM.

Fig. 1.

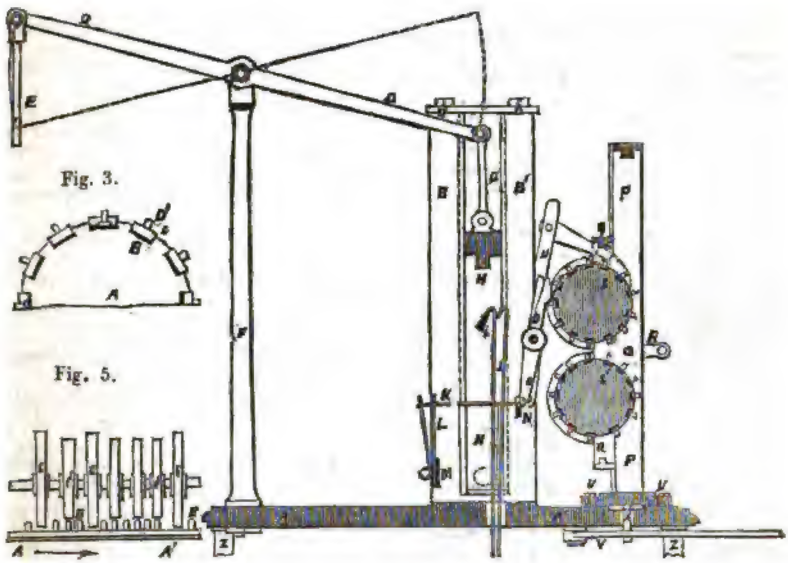


Fig. 3.

Fig. 5.

Fig. 4.

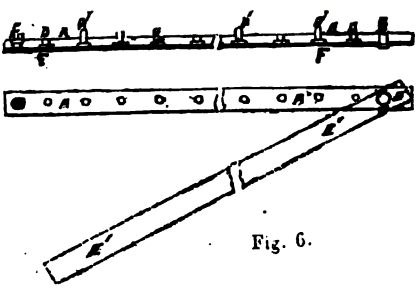


Fig. 6.

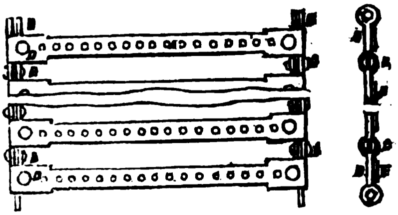
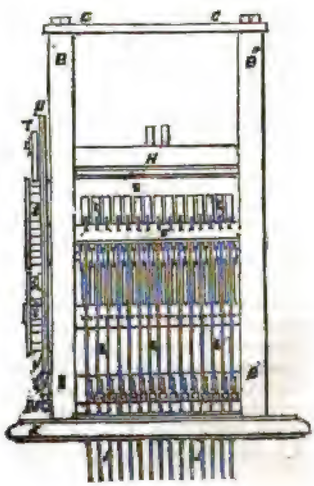


Fig. 2.



FONTAINEMOREAU'S PATENT JACQUARD LOOM.

(Patent dated May 22, 1849. Specification enrolled November 22, 1849.)

There has been much talk of late of some vast improvement made in the Jacquard loom in the country of its invention, and patented in England, on behalf of the inventor, by Mr. Fontainemoreau. We now give the specification in full. The invention, it will be seen, consists chiefly in superseding the necessity for the exceeding number of cards required in figure-weaving by the Jacquard loom—an object unquestionably of the utmost practical importance.

Fig. 1 of the engravings represents a sectional elevation of this improved loom; and fig. 2 a sectional view of the apparatus with two cylinders. A is the foundation plate, which supports the improved apparatus above the loom. B B B′, B′, are upright beams, provided with grooves into which the frame, H, slides. C C′ is a cross-piece for connecting the upright beams, B B, B′B′, at top; and D is a lever having its fulcrum at π, on the columns, FF, which serves to guide the frame, H. The dotted lines, fig. 1, represent the action of that lever, when giving an ascending motion to the frame, H. E is a connecting-rod, which receives its motion through the lever, D, from the main shaft of the loom, by means of connecting-rods and levers, or otherwise; and which serves to transmit the movement of the lever, D, by means of the connecting-rod, G, to the frame, H, which is caused to slide by the action of the lever, D, and the rod, E, between the grooves made in the upright beams, B B, B′B′, and to impart motion to the lever, U. I I′ is a cross-basil bar set within the frame, H, whereby the upright hooks, J J′, are raised, when the keys, O O′, bring them to the front. J J′, represent the upright hooks for raising the leashes or lames. K K, are horizontal conductors or needles, through which each of the upright hooks, J J′, passes. These conductors cause the upright hooks, J J′, to approach or to recede from the cross-piece, I I, according to the motion of the keys, O O′, which have their lower extremities attached to the conductors, KK. LL are spiral springs, which are attached at one end by means of pins to the conductors or needles, K K, and at the other end by hooks to the cross-piece, M, and serve to bring back the keys, O O′, when their upper extremities, which bear upon the cylinders, have left the pegs. M is a cross-piece supporting all the spiral springs, LL, and to which these last are attached at one of their ends by means of small holes. N is a cross-piece for stopping the ends of the moveable keys, O O′, which are placed and move upon the axis, π', which carries them all, and which is set on the upright beams, B′B′. These keys are put in motion by the pegs with which the cylinder, S, is provided. The number of the keys, O O′, of the upright hooks, J J, of the conductors or needles, K K, and finally of the spinal springs, L L, is the same. S is a cylinder provided with any suitable number of moveable pegs for causing the keys, O O′, to work according to the required patterns; they are set in and removed from the cylinder, S, by one of their extremities, which terminates in a screw for that purpose.

The axis of the cylinder, S, turns freely in bearings set close to the axis of the keys, O O′, on the bearers, B′B′. T is a click and spring-work for moving the toothed wheel, with which the cylinder is provided, and by which the rotary motion is given to it. U is a bent lever, receiving its movement from the frame, H, by means of the small roller, *a*, with which this lever is provided. When the frame, H, ascends, on account of the motion communicated by a lever, D, to the rod, E, the lever, U, is drawn back by the action of the spiral spring, *b*, which returns to its natural position; this movement of the lever, U, causes the double click, T, to engage the cog of the toothed wheel, whereby the cylinder is stopped; when the frame, H, descends by the contrary motion of the lever, D, the lever, U, rises up again, and being pressed by the smaller roller, *a*, causes the toothed-wheeled conductor of the cylinder, S, to advance, and this last communicates the same rotary motion to the cylinder. S. Z, Z′, are columns connecting the plate, AA′, which supports the Jacquard machine with the other part of the loom. *a* is a small roller set at the lower extremity of the frame, H, which gives motion to the lever, U. *b* is a spring which acts on the bent lever, U, and causes it to return to its proper position.

In the ordinary process of producing figured tissues or ties, each design requires a special set of cards; but by the application of this apparatus, several patterns can be worked by the same cylinder, without causing any delay or stoppage of the work.

For this purpose, a number of pegs, double that of the keys, is set on the cylinder, S, and each peg corresponds at first to every

key, which produces a design; another peg is inserted in the space which separates each key, whence it follows that, to have the pegs acting on the keys, O O′, it is only required to cause the cylinder to advance sufficiently to have the pegs acting under the keys; the other pegs, which were operating before, will occupy the empty spaces, which are replaced on the work by the other pegs. By such means, the cylinder, S, affords the facility of producing two designs. This system may serve to multiply the designs by employing two or more cylinders, prepared as before stated, and set under the cylinders, S.

This arrangement is represented by fig. 2, which is a sectional elevation of the apparatus provided with two cylinders. The plate, A A, is prolonged sufficiently on the side opposite to the column, F, to receive the two supporters, P P′, similar to the supporters, B B, B′ B′, and connected at top by the cross piece, C C, and at bottom by the carriage, V V, which can be moved by means of the lever, X, in a direction parallel to the axis of the two cylinders, S S′; on these supporters, P P′, slides the frame, Q, of the two cylinders, S S′, which is free to ascend or descend on the frame, P P′, by means of a rack, put in motion by the handle, R. The range of this rack is such, that the lower cylinder, S′, can take the place of the upper one, S, whereby they are placed against the centre of the top of the keys, O O′, and can be made to produce separate patterns, without stopping or even causing delay in the working of the loom. The number of these cylinders can be increased according to the series of patterns to be executed.

Fig. 3 represents a cylinder provided with the plates, fitted with the pegs for actuating the keys, O O′. A is a wooden or metal cylinder; B, B, B, the sole plate, which supports the pegs when they are placed on the upper band, C, which is of brass, and pierced with holes to receive the pegs according to the designs to be worked on the tissue. D′, D′, D′, are the pegs to raise the keys, O O′ (figs. 1 and 2) during their rotary motion round the axis of the cylinder.

Fig. 4 represents a section and plan of one of the plates or bands, on which the pegs, D′, D′, D′, are set. This plate is composed of two parts, the upper one, A A, being pierced with equidistant holes to receive the pegs, D′, D′, D′, while the lower part, E E, turns on one side upon a pivot over the first part, and is kept on the other side by means of a screw. The object of this apparatus is to maintain all the pegs, D′, D′, D′, in the holes wherein they have been placed. A A represents the upper brass band, provided with counter-sunk holes to receive the head of the pegs, D′, D′, D′.

B B is the axis on which the band, E E, turns; C, iron screws uniting the bands, A A and E E; D, D, D, holes properly disposed on the bands to receive the pegs.

E′ E′ indicate the position of the band, E E, when it is opened, in order to change the position of the pegs.

Fig. 5 represents the manner in which the pegs, D′, D′, D′, raise the keys, O′O′, the number whereof is half less than that of the pegs, D′, D′, D′, so that a single movement in the direction of the arrow will alter the working of the pattern, by causing the keys to be in communication with pegs placed in a different position.

A A′ represents the plate fixed upon the cylinder before described when speaking of fig. 3, which is provided with moveable pegs.

B, B, B, C, C, C, C, are the disconnected keys, that is to say, the keys which are to be acted on by the pegs, B, B, B; C′, C′, C′, C′, represent the keys put in motion by the pegs, B, B, B. It is often necessary to work large patterns in the tissue, when the circumference of the cylinder, A, fig. 3, may not be sufficient for their production, although its diameter cannot be increased to the required extent, without complicating or rendering the apparatus too heavy. To surmount this difficulty, an endless chain, composed of the metallic horizontal bands or plates, provided with pegs, is employed. The metallic plates are not set horizontally round the cylinder, as before described, fig. 4, but are united one to the other at their two horizontal extremities by hinges, which render them perfectly moveable: the cylinder, in this case, is provided with proper pins, set round at each extremity of its horizontal length, which are caused by the chain, on its being put in motion by the rotation of the cylinder, to act on the keys, C′, C′, C′, C′, whereby all that which the cards can produce is obtained by an arrangement much more certain and quicker. The plates are always the same, whatever may be the pattern to be executed; the pegs alone vary in their position; but the arrangement of them is effected with the utmost facility and precision, and nothing can disturb their action, so that all mistakes can easily be rectified, if any were to occur.

A A′ (fig. 6) represent the link of the chain, which is composed of the horizontal metallic bands or plates set with pegs, in a manner similar to the plates represented by fig. 4. B B′ are the hinges; C, C, C, the axis of the hinges; D D′, the plates carrying the pegs; E, E, E, lower bands supporting the pegs. Instead of placing on the cylinder, A (fig. 3),

the metallic plates, A A (fig. 4), or the endless chain formed of a number of metallic plates (fig. 6), and provided with pegs, as before described; these plates, either separately, or as an endless chain, can be set on the cylinder with their surface perforated with suitable holes at the required distance. In that case, the head of the key, O O′ (fig. 1), will be made to enter by the rotary motions of the cylinder, into the holes of the plates, and will give the necessary movement to the conductors, K K′, and to the upright hoops, J J′, as before described.

For claims, see p. 523.

(To be continued.)

COAL MINE VENTILATION — MR. BRUNTON'S AND MR. LLOYD'S MACHINES— AN OLDER THAN EITHER.

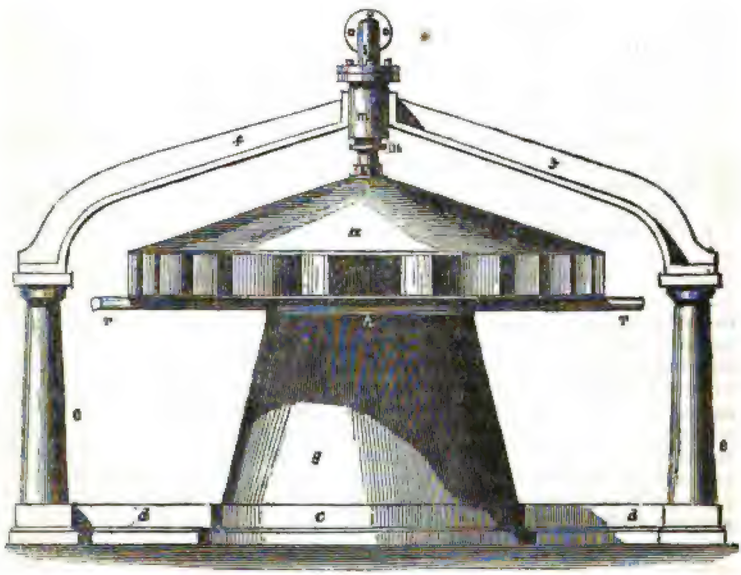
Sir,—I observe in the *Mechanics' Magazine*, of Saturday last, some account of an apparatus for ventilating coal mines, extracted from a pamphlet just published by Mr. Brunton, and as that apparatus is almost identical with one which I erected in June last, for the same purpose (and patented nearly five years before), I think it due to myself to put in a claim for priority of invention, both as regards Mr. Brunton and Mr. Lloyd—both of whom, however, I can readily suppose were not aware of what I had done. My intention in putting up the apparatus I have referred to as being erected in June last, was to show experimentally its applicability for the ventilation both of *mines* and *sewers*, and I therefore cannot now allow the matter to pass unnoticed, lest I should hereafter be thought to be a mere copiest of the inventions of others. I hope, therefore, you will allow me a space in your valuable columns to give a description of my apparatus, and to relate the means which I took on a former occasion to bring it under the notice of those most interested.

When the Select Committee of the House of Commons was appointed to examine the causes of explosions in coal mines, I thought it a favourable opportunity for bringing forward my plan of exhausting the air by mechanical means; and upon the first intimation in the *Times* of the appointment of the Committee, I commenced constructing the apparatus (of which I enclose a sketch). In the mean time, two shafts were sunk on my premises, communicating with each other by an underground tunnel; the whole was lined with brick in cement, and when finished, presented an uniform bore throughout of 3 ft. 6 in. in diameter, one shaft being left open to represent the down shaft of a mine, while over the other, or upcast shaft, was fixed the exhausting apparatus connected with an engine of about four-horses power, and capable of drawing out 15,000 cubic feet of air per minute. The whole was completed, and worked by steam, on the fourteenth day after the notice first appeared in the *Times* of the appointment of the Committee. A series of experiments was then made with it, which clearly showed its applicability to the intended purpose. From these I select the following, as affording sufficiently striking evidence of the efficiency of the apparatus.

A very open iron grating was placed over the downcast shaft, and a large heap of shavings piled upon it. A lighted match was then applied to the top of the heap, and the exhauster set agoing. The flame and smoke both passed downwards with immense velocity through the whole mass of shavings, and, carrying air with it, a vivid combustion took place, the flame descending in a vast body, and reaching from 8 to 10 feet down the pit, while none of the smoke or flame ascended from any portion of the burning mass; the general law of the ascent of heated air and flame being thus inverted by the more powerful agency of the apparatus operating against it, showing at once its superior force over the ordinary means of creating an upward draught by fire. In another experiment a flat disc of wood was made to fit loosely the side walls of the upcast shaft, so that it might move up or down the shaft freely, and three cords were attached near to the edge of the disc and united in a loop, in the same way as the cords of a common pair of scales are fixed to the boards,—except that the scale in this case was inverted, and the cords placed downwards. At the loop where the cords unite, a half hundred weight was suspended. The disc being placed in the bottom of the upcast shaft, and the exhauster put in motion, the disc with its load rose instantly, striking the under side of the apparatus violently, and remaining suspended as long as the apparatus was supplied with steam. In this way 84 lbs. was taken up; so that in a mine where the shaft is 6 feet in dia-

meter, a man of 12 or 14 stone, holding a disc over his head like an umbrella, would be hurried up the shaft with a powerful velocity. (I don't recommend this sort of balloon ascent, but merely mention it as illustrative of the force of the upward current of air produced by my apparatus).

Having made all the necessary experiments to show the applicability and economy of my plan of ventilation, I was desirous of being examined by the Select Committee. To forward this object, the Earl of Devon, with the usual interest he takes in these matters, kindly gave me an introduction to the chairman, Lord Wharncliffe, who received me with the greatest politeness and attention, but at the same time informed me that I could not be called before the Committee because my invention had not been actually applied to a coal mine—and so all the trouble and expense I had been at went, for the time at least, for nothing.



In the accompanying sketch *a* represents the fan, which consists of two discs of sheet iron, the lower one flat, and having a large hole on its centre, while the upper one is coned slightly, and is attached in the centre to the vertical shaft, *b*. The two discs are united by a number of vertical radial partitions; on the curb of the upcast shaft is placed a cast-iron ring, *c*, having three arms; *d*, proceeding from it, at the extremities of which the columns, *e*, are fixed, the upper ends of these columns having an arm, *f*, cast upon them, so that they may unite in the central boss, *m*, and form a complete frame for the apparatus. A sheet iron cone, *g*, is fixed on the ring, *c*, and extends upwards to the line, *h*, where the revolving opening into the fan comes as close as possible to it without touching, and thus prevents the ingress of the external air. The arms, *d*, extend through the ring, *c*, and form a boss at their junction in the centre, and in an oil cup formed in this boss the lower end of the vertical axis *b*, revolves; the upper end of it passes through the stuffing-box, *n*, into the boss, *m*. The axis, *b*, is tubular, and has two arms, or jet pipes, *r*, united at right angles to it, so that when steam is admitted through the pipe, *s*, the issue of it through the bent ends of the arm, *r*, will cause a rapid revolution of the axis, *b*, and conse-

quently of the fan, then the portions of air contained between the vertical partitions of the fan being acted upon by centrifugal force will be rapidly thrown out, while fresh portions of air will rush up the shaft to supply their place, and thus the ventilation of the mine will be affected.

I am fully aware of the loss of power consequent on using the emissive engine under ordinary circumstances; but I would here remark, that when an emissive engine, making from 3 to 4,000 revolutions per minute, has its speed brought down by a series of drums and straps to 60 or 80 revolutions per minute (as is usual in order to test its power as compared with the ordinary piston engine), much of its power is absorbed by the friction and atmospheric resistance of the intermediate gearing, and more particularly by the slip of the strap on the engine shaft. Again; when the ordinary piston engine is required to move a fan at some 1,500 or 2,000 revolutions per minute, the intermediate drums, straps, and shafts, required to get up this speed also absorb a large proportion of its power; so that where very high velocities are required, the duty done by the emissive and piston engines will approach much nearer than the general estimate formed of them. In this view of the case, however, we are still regarding the steam engine and fan as two separate and distinct machines, each having its own friction and resistance, with the addition of the pull of a strap to connect their motion; but it will be observed, that in my apparatus I have only one revolving piece, and *no pull* whatever of straps, and moreover, that the vertical position of the axis prevents all lateral friction in bearings, since the whole machine revolves upon one steel pivot in an oil cup; from all which it must be evident that the loss of power attending the emissive engine does not apply to the present combination of it with the fan. But in any case it is a mere question of quantity of steam, and consequently of fuel, and this at the mouth of a coal-pit need not be much insisted on, while the great simplicity of the apparatus (consisting as it does of only one moving piece) renders it certain in its operation, and capable of enduring years of constant and unremitting action without requiring any stoppage for repairs; to which great advantages may be added, that it is exceedingly cheap of construction.

In conclusion, I beg to call the attention of your readers to six important points in respect of which my apparatus differs from the ordinary blowing fan, and in which Mr. Brunton's resembles mine.

Firstly, The vertical position of the axis in which it revolves.

Second, The admission of air on one side only of the fan.

Third, The fixing of the blades between the discs, without radial arms for their support.*

Fourth, The revolving of the discs with the blades.

Fifth, The entire omission of the excentric casing.

Sixth, The direct action of the engine on the axis of the fan.

On the latter point I have only to remark, that a fan of 4 feet in diameter is required to make at least 1,200 revolutions per minute to produce the requisite exhaustion, and, therefore, if Mr. Brunton's engine is worked at the high speed of 120 double strokes per minute, his fan must be made 40 feet in diameter! (a very different sort of thing to the very tiny affair represented in the sketch in the Magazine). The cost of such a fan with a steam engine to work it, as compared with the one I have described, I leave to your readers and the public to decide. Trusting the importance of the subject at this moment will plead in excuse for my trespassing so far upon your valuable space,

I remain, dear Sir,

Yours most truly,

H. Bessemer.

Baxter-House, Old-street, Pancras-road.

APPLICATION OF ALGEBRA TO ASTRONOMY.—THE SUN'S RADIUS MEASURED BY MATHEMATICS.

Sir,—May I beg of you to publish this letter, and the under-mentioned synoptic table of the solar system, in your scientific Magazine. The method employed to find the results expressed in the table is quite new, and demonstrable by geometry and algebra, not having re-

* The use of curved blades, as shown in Mr. Brunton's plan, have long been abandoned, as they were found to greatly retard the egress of the air.

course to a transit, which is the general one used now by astronomers for finding the distance of the earth from its central luminary. I have not sent you the general equations, only the quantities obtainable from them; which will prove, I trust, a source of pleasure to the scientific readers of your Magazine, at least to those who take an interest in the science of astronomy.

Your readers are, Sir, no doubt, aware of the great importance of this question in the sciences, since it has engaged the attention of mathematical men from time immemorial. The earth's distance from the sun has been variously calculated by different astronomers. Ptolemy, Copernicus, and Tycho Brahe, thought it to be 1200 semidiameters of the earth. Kepler made it nearly 3500; Ricciolus doubles the distance mentioned by Kepler; and Helvetius made the distance to the sun about 5250 radii or semidiameters of the earth.

There were other astronomers that attempted the same thing. Aristarchus, of Samos, endeavoured to measure the sun's distance by dichotomization, or bisection of the moon. Hipparchus' method was by an eclipse of the moon; and Dr. Halley's by a transit of Venus. To enter into detail upon these methods would be useless; it may suffice to say that they are all more or less erroneous, which must be the result attending an observation upon an object so far distant as the sun.

These remarks show that this grand question has been the theme of inquiry for ages. I have, after mature and laborious study, attended with great difficulty (situated as I am), brought this grand astronomical problem down to an equation; which result can be verified step by step with axioms or self-evident truths.

Problems 1, 2, 3, and 4, mentioned in my "Analytical Abacus," are demonstrated in my work.

Problem 5 is a mathematical method for measuring the sun's radius, obtainable from a knowledge of the properties of the ellipse.

Problem 7 gives the length of a planet's day.

Problem 8 is an important angle for finding the eccentricity of a planet's orbit, and it will prove we are carried round the sun in an orbit much nearer to a circle than what astronomers have hitherto made it.

I hope these remarks will not make too great an encroachment in your scientific Journal, and will meet with the attention which the importance of the question involved deserves. I am, Sir, yours, &c.,

JOHN KING.

Upper Brook-street, Ipswich, Suffolk, Nov. 22, 1849

An Analytical Abacus, or Synoptic Table of the Solar System. By John King, Algebraist.

Prob. 1	The greatest distance of a planet from the sun ..	$=\dfrac{(a+b)s^2}{4bz}$
,, 2	The least distance of a planet from the sun.. ..	$=\dfrac{(a+b)s^2}{4az}$
,, 3	The mean distance	$=\dfrac{(a+b)^2s^2}{8abz}$
,, 4	The eccentricity of a planet's orbit..	$=\dfrac{(a^2-b^2)s^2}{8abz}$
,, 5	Apparent semidiameter of the sun in decimals of a degree, as seen from the planets when at their mean distances	$=\dfrac{180\,z\sqrt{d}}{p\,s^2}$
,, 6	Apparent radius of the planets, as seen from the sun when at their mean distance from that luminary..	$=\dfrac{360\,z}{p\,s}$
,, 7	The length of a planet's natural day when at Perihelion, supposing the length of the day at Aphelion to be unity	$=\dfrac{1+2\sqrt{2}\sqrt{z-z^2}}{s}$
,, 8*	A planet's focial angle, GFJ, on the day of the planets' equinoxes	$=\dfrac{360\sqrt{2z-2z^2}}{p\,s}$
,, 9	Mean orbicular velocity of a planet in a second of time	$=\dfrac{ps^2}{ez}+\dfrac{p-pz}{e}$

* See my work lately published for finding the distance of the earth from the sun (independently of its parallax), which angle I do not consider to be necessary for determining distance.

a = The length of a planet's natural day when at Perihelion.

b = The length of a planet's natural day when at Aphelion.

e = The length of a planet's solar year in seconds.

s = The radius of the planet.

z = The versed sine of the inclination of a planet's poles with its equator.

p = The circumference of a circle when its diameter is unity.

d = The axis major of the earth's orbit multiplied by the radius of the earth.

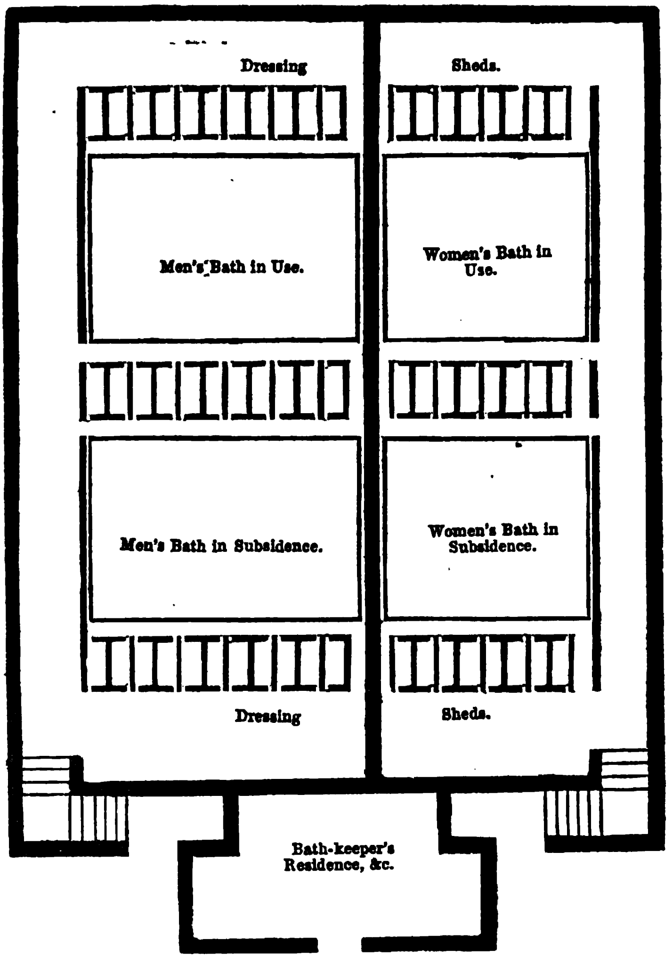
FUNERAL CARRIAGE.

[Registered under the Act for the Protection of Articles of Utility. Charles Edmund Butler, of 31, Farringdon-street, Furnishing Undertaker, Proprietor.]

A A is the carriage body; B B, the seat for the mourners, which is placed longitudinally in the middle of the carriage, so that the passengers sit back to back. The box forming the seat is made perfectly air-tight inside of the carriage by a covering of lead or gutta percha. It descends a little deeper than the floor, and forms a chamber, C, of sufficient size to hold one or two coffins. The chamber, C, has openings, D D, in the bottom, to allow of a free circulation of air, and thus affords protection to the mourners from any injurious emanations. E is the door of the chamber.

PLAN FOR THE BETTER SUPPLY OF SEAPORT TOWNS WITH SEA-WATER.

Sir,—The following plan for supplying water to baths in the low parts of seaport towns, where they would be most useful, being generally the most densely populated by the labouring classes, who can least afford time to travel far for sea bathing, was presented, in the form of a memorial, to *The Town Council of Liverpool;* and as the plan it describes will apply equally to all towns having tidal harbours, or rivers with *main sewers* emptying into them, I would present it, in its original shape, for the consideration of the authorities



of such places, if you would so far oblige me as to give it insertion in your universally-circulated Magazine. The prefixed sketch exhibits the plan of such an establishment as I had in contemplation.

I am, Sir, yours, &c.,
ROBERT BAINES.

Oxton-hill, Cheshire, Oct. 20, 1842.

(*Copy.*)

To the Worshipful the Mayor, Aldermen, and Common Council of the Borough of Liverpool.

Gentlemen, — The continuing encroachments on the shores of the River Mersey by the extension of docks will deprive the inhabitants of this borough

of sea-bathing within any moderate distance of their residences, unless some mode of remedying artificially the privation of a sea-shore be adopted.

Your memorialist has long thought this might be effected at no very great expense, if, instead of filtering the water before it is used for bathing, the principle of allowing it to cleanse itself by subsidence were acted upon; and should most respectfully suggest, that where it is intended to have baths or reservoirs for sea baths, *two* should in every case be made, and alternately used, in which case the water taken into the one at flood tide would have the whole of the next day and the night-time for its impurities to subside, before it would be wanted, the other being used during the interval.

To prevent the intermixture of these impurities with the mass while people are using the bath, an intervening body might be introduced between the subsided impurities and the clarified water, which might be done two ways, either by sinking a false bottom to, say *one foot* from the bottom of the bath, immediately before it is required to rise; or by drawing from one side of the bath to the other a water-tight canvass at the same distance (say one foot) from the bottom. Any annoying communication between the purified and impure waters would be thus cut off, and in the act of sinking the false bottom, or drawing the canvass across the bath, no disturbance need be occasioned.

Your memorialist has been informed by practical men that several of the *main sewers* would* admit of men entering them to lay *iron pipes* of sufficient delivery to supply water to a bath or reservoir of any requisite capacity, during the time the water in the river is at flood; and in that case, the baths need not be confined to one locality, but might be *in number as many as the main sewers* would permit of pipes being brought through them, and the site of a bath might be any place adjacent to such main sewer, but within the limit where the sea-water has reached *a given elevation.*

It will be found that during the six months beginning with May and ending October of the present year, the tides under 13 feet will be 42; those of 13 feet and under 14 feet, will be 19; and those of 14 feet and above, will be 123.

Supposing the baths to be made with relation to the tides of 13 feet, and to be 6 feet deep, this would give 7 feet elevation to the bottom of the baths above the Old Dock sill, and supposing the sewers to have a fall of 15 feet to the mile, this would allow of the baths being brought inland 821 yards; but as the pipes would have to follow the fall *actually* given to the sewers respectively, the distance inland must be governed by that circumstance.

It will be obvious that at higher tides than 13 feet, the supply-pipes must be closed when the baths are filled. The tide of 13 feet is here selected only as elucidative of the proposition; but a higher tide than this might with safety be worked upon, as will appear from a classification annexed of the heights of tides during the six months in question, and especially as the allowance of *one foot* from the bottom of the bath, for the subsidence of impurities, is at least as much again as would be necessary.

The mouths of the supply-pipes might be carried into the tideway in the rivers, and, by an* appliance thereto, the water might be taken from any distance below the surface. The baths might be emptied either through them at low water, or otherwise conveyed into the main sewers —serving in so far to flush them.

The above suggestions will have reference to the part of the shore which has long been occupied by the old town, but to that about to be taken away by the projected extension of the docks northward, they will not apply—the ground being here still free to operate upon as may be thought best.

If the surface of the land chosen for the site of a bath were above the proposed elevation of 13 feet above the

* The difficulty is the confined space in which men would have to work, but this might be obviated by the improvement in connecting iron and stoneware pipes patented by Mr. Martin, Lindsey-house, Chelsea, by which the time expended in packing with lead, as well as the expense of that material, is saved; and the connection is immediately effected by his *wedge clip* when the two ends are brought into the required contact.

* The *appliance* alluded to consists of revolving arms placed at the ends of the supply-pipes, of such length that the orifices might be raised above the level of the highest tide when at flood. These should be floated at a given depth, say a foot, below the surface as the tide is rising, and when the baths are filled, by raising the orifices out of the tide water, all further flow into the baths would cease. The gutta percha tubes would answer the purpose, being easily adjustible, flexible, and light.

dock, sill, or *datum*, the access to the bath must of necessity be obtained by excavating that surface to such proposed elevation of the surface of the water, and, as of old, the people must go down to bathe. This would be opposed to an ingenious project which has been before your council, of sending them up the hill, where they are to find the water filtered and forced up; but unfortunately, at the expense of labour, fuel, and machinery, the outlay for which must be returned to your corporation by the public, at a greater charge for admission than possibly might otherwise be required. An admission-price, from six in the morning till twelve at noon, might be exacted, which would support the establishment, and in the afternoon the baths might be *free*.

Your memorialist humbly presents the present as the outline only of a plan, in the hope it may induce inquiry into its practicability in detail.

ROBERT BAINES.

Liverpool, June 7, 1849.

PERFORATED GLASS WINDOWS.—IMPROVEMENT SUGGESTED.

Sir,—If the rules of your *Mechanics' Magazine* permit, I would beg through its pages to obtain the attention of glass manufacturers towards the value of perforated glass for ventilation, similar in design to the specimen of perforated zinc which I enclose. I am aware of one patent, by Mr. Lochhead, for perforated glass; but for the beneficial ventilation of dwellings, hospitals, &c , it has two serious objections: first, the perforations are too large, and the air is thus admitted in too great a body; secondly, the surface is smooth on both sides, which admits the rain, requiring an external sash as a shield in wet weather. The advantages possessed by the perforated zinc are, 1st. The orifices are sufficiently minute to divide the fresh cold air admitted, so that it shall easily incorporate itself with the internal atmosphere, instead of descending in a continuous cold stream into the apartment, and probably affecting injuriously the person within its direct influence.

2nd. The *external burr* prevents the admission of wet, even when exposed to the violence of a storm,—permitting in consequence the ventilation (*i. e.*, the admission of fresh air) to be continued when ventilators according to Mr. Lochhead's patent would have to be closed. The evils of the admitted rain, also of the descending stream of cold air in crowded hospitals, where patients must be placed under the windows; also in crowded barracks, where the same necessity as regards the soldiers' beds exists, need only to be mentally dwelt upon to be acknowledged as serious, particularly during the quiet of the night—a time when such assistants to ventilation are most required.

The objection to the zinc is its opaque nature, rendering its use in front windows unsightly, and causing a loss of light where, probably, it can ill be spared. Glass, therefore, is sought to be substituted as the material, and the desired object is to obtain perforated glass, having the perforations one-eighth of an inch in diameter, with a burr, as from a punch, externally,—the perforations one-half inch distant one from the other. The manufacture to be in sizes or squares applicable to stopping in sashes of all dimensions. A margin of a plain surface may be left, for glaziers to reduce as required. It is essentially necessary that the price should be moderate.

If the subject be considered worthy of a trial by such ingenious improvers as Mr. Bessemer and others, there seems little doubt as to its successful manufacture.

It is admitted that the most simple mode of ventilation is the one most desirable, and most likely to be permitted by the occupants of crowded rooms. The very necessity for the admission of fresh air, renders the occupants less able to bear contact with any rush or stream of cold atmosphere; thus the opened door or window is the readiest means, but speedily produces its chill, and is again closed by shuddering hands. A like effect, and a similar fate, follows the employment of any ventilator admitting any considerable body of cold air. The application of the glass, perforated as described, is to substitute it for common glass in one or more squares, as required, of the window sash, gaining therefrom a gentle and easily-diffused supply of fresh air. In poor-houses, barracks, hospitals, or gaols, such an assistant to ventilation (under trial of the zinc) has been found most valuable and

successful, and from the speedy incorporation or mixing of the atmosphere within the apartment, no inconvenience is felt, and no temptation is given to the occupants to tamper with the means of gaining a supply so necessary to health.

In private houses, ball-rooms, &c., the adoption would be found invaluable, and save the lungs of many of our fair young ladies, so often sacrificed to heated rooms and rash contact with the cold night air admitted through an opened window. In such applications the perforated pane might be guarded by an inner glazed slide, or small sash, somewhat similar to Mr. Lochhead's design.

The present, or any other means for supply of fresh air must, however, invariably be seconded by means of escape for the heated and vitiated atmosphere.

I am, Sir, yours, &c.,

R. E.

Dublin, Sept. 15, 1849.

SMITH'S PATENT IMPROVEMENTS IN MANUFACTURING AND SETTING UP WIRE ROPE.

[Patent dated May 22, 1849. Andrew Smith, of St. James's, Westminster, Engineer, Patentee. Specification enrolled November 22, 1849.]

Specification.

Firstly, my invention, in so far as it regards machinery for or methods of manufacturing rope or cordage has relation to the means employed to give motion to the reels or bobbins in laying the yarn or wire into strands, or in laying strands into rope or cordage, and consists in the improved arrangements for that purpose represented in figs. 1 and 2, the former of which is a plan of the machinery on the line *yx*, and the latter a side elevation thereof. The bobbins or reels, *gg* (of any convenient number) are mounted in a circular frame, A, which is upheld by screw-rods, *vv*, within an outer framework, A^2, consisting of a basement, *k*, four pillars, *pp*, an entablature, y^1, spandrils, x^1 x^1, and conical apex, *w*. The principal parts of the frame, A, are three six-armed rings, R^1, R^2, R^3, which are connected vertically together in the manner to be presently explained, and two laying plates, *tt*, at top of all. The undermost ring, R^1, is connected by a series of cranks, C *ee*, with the second ring, R^2, and R^2 with the third ring, R^3, by straight vertical rods, *ss*. The centre crank, C, is stationary, and stepped by its short arm in a pedestal, N, attached to the basement of the outer framework, A^2, while the undermost ring, R^1, is attached to a loose boss, *r*, slipped over the short arm of the crank, C, so that on a rotating movement being given to the ring, R^1, it carries round with it the ring, R^2, by means of the side cranks, *ee*, that is to say, the side cranks, *ee*, which may be called live cranks, are made to revolve round the centre or dead crank, C, while the ring, R^2, in its turn imparts, through the medium of the vertical rods, *ss*, a simultaneous rotary movement to the top ring, R^3. The long arms of the connecting cranks, *ee*, carry the reels or bobbins, *gg*, on which the yarn or wire is wound, and as they revolve at fixed and invariable distances round the centre or dead crank, C, any twist of the yarn or wire which is in the course of being laid is effectually prevented. The requisite rotary motion is given to the machine by means of a pair of bevel wheels, B^1 and B^2, the former of which (B^1) is attached to the loose boss, *r*, on the short arm of the dead crank, C, and the latter, B^2, to a shaft, S, which is turned by a steam engine, or other first mover, through the medium of the riggers *aa*. The long arm of the dead crank, C, carries at top a reel or bobbin, *u*, from which the heart or core for the rope or cordage (of whatever material such heart or core may be) is supplied. The yarns or wires from the different bobbins pass through guide holes in the topmost ring, R^3, and meet and unite with the core at the laying plates, *tt*. To the revolving shaft, S, and at a little distance from the riggers, *aa*, there is attached a worm-wheel, *h*, the threads of which take into a tangent wheel, *i*, and thereby give motion to a whelp wheel, *j*, keyed to the axis, k^1, of *i*. The whelp wheel, *j*, serves to receive or take away the strand or rope as it is delivered from the twisting or bobbin frame, A, over the pulley, Q. The whelps, *ll*, of the wheel, *j*, are moveable to and fro in slots, as usual, so that they may expand or contract (as it were) in proportion to the lay of the strand or rope. On the axis, *k*, of the wheels, *i* and *j*, and outside of both, there is keyed a flat grooved rigger,

m, which is connected by a band, n, to a similar flat grooved rigger, o, keyed on a separate shaft, P, which carries a dou- ble w' or p'

...lished, and as ...commenced, ...ious points ...ns of the ... consist, ...ht sig- ...loons, ...tmo- ...uch ...a-

Fig. 3.

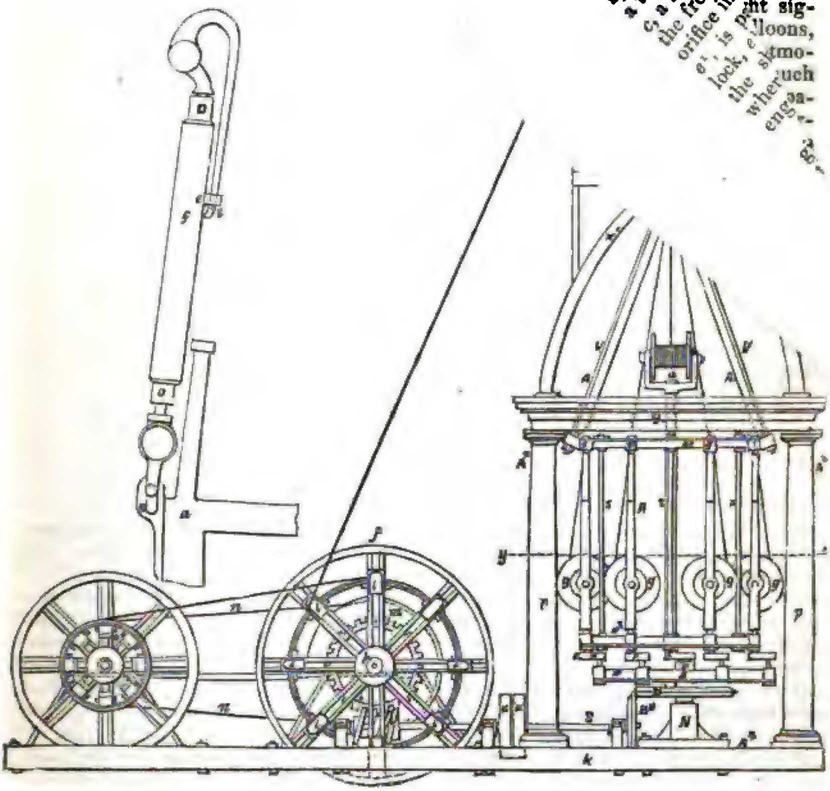
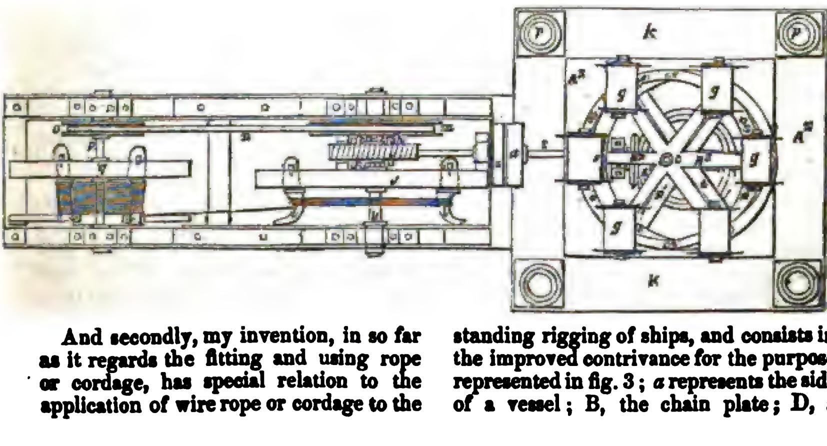


Fig. 1.



And secondly, my invention, in so far as it regards the fitting and using rope or cordage, has special relation to the application of wire rope or cordage to the standing rigging of ships, and consists in the improved contrivance for the purpose represented in fig. 3; a represents the side of a vessel; B, the chain plate; D, a

successful, an of the ordinary form; *f*, ration or mich the lanyard is enclosed; the apartmckle; *e*, a stud attached to and no tof the tube, *f*, and having an cupants it, through which the forelock, gainingssed. By taking out the fore- In p, and pulling down the tube, *f*, adoptackle slips up and opens out, saveeby the rope can be instantly dis- ladged as may be required.

an*Claims*.—First, I claim the mode of giving motion to the reels or bobbins in the manufacture of rope or cordage before described, in so far as regards the employment of a central stationary crank, C, and of other cranks, *ee*, carrying the reels or bobbins, and made to revolve round the same at fixed and invariable distances.

And second, I claim the combination of the slip shackle with the elastic screw lanyard, as before described.

AERONAUTIC PROJECT FOR THE SUCCOUR OF SIR JOHN FRANKLIN AND HIS COMPANIONS.

Sir,—When it so happens that a difficult problem is published to the world, and similar ideas occur to various individuals not having any communication with each other, as to the best means of effecting its solution, I think it may reasonably be inferred that some degree of feasibility may attach to their several conclusions, notwithstanding they may appear to the generality of mankind as rather visionary and impracticable. I merely make this remark, in consequence of perceiving by the newspapers, that Lieutenant Gale (one of the most enterprizing and experienced aëronauts of the present day) has proposed the employment of balloons as a means of enabling persons to discover from an immense distance the vessel containing Sir J. Franklin and his enterprising companions; which suggestion happens to coincide with ideas which occurred to me long since as to the practicability of delineating the internal portion of the polar regions (say to 100 miles and upwards in extent, by means of telescopic observations, and sketches, made at various points from the car of a balloon, conveyed in a steam or sailing vessel around the sea-girt coasts and boundaries of the Arctic regions, from the deck of which the balloon might be elevated or lowered at pleasure by ropes, windlasses, &c. The distance run, and course of the vessel, would of course be ascertained by the log and compass; so that with the aid of the aëronautic observations, persons might be enabled by the direction and trending of the several inlets to form a pretty reasonable guess as to the probable existence either of an eastern or western passage. Without, however, making any further reference to this very interesting subject, I will proceed at once to that which is of much more immediate importance, namely, the suggestion of certain additional means differing from any hitherto put in practice, for ascertaining the precise position of Sir J. Franklin and his party, and (if still in existence) of communicating with them, and of affording them the means of communicating in return, and even of possibly supplying them with provisions for their immediate sustenance, until some method can be devised to rescue them from their present forlorn condition. One of the peculiar advantages of this suggestion consists in its capability of being put to the test, without much loss of time; even during the present winter season—without risk of life or any vast expense. And when it is considered that the lapse of a few months or weeks only may constitute all the difference between life and death to these meritorious individuals, I feel quite satisfied that neither the Government nor the public will deem any reasonable pecuniary sacrifice too great for the trial of any experiment affording the slightest chance of effecting so desirable an object. My proposition is as follows, viz., that another expedition should be immediately fitted out, to consist of (say)

1. One large sailing vessel containing every requisite for the comfortable accommodation of the several members of the expedition.

2. One or more other large sailing vessels, merely for the conveyance of coals and stores of various kinds.

3. Three small steam tug-boats in tow of the above sailing vessels, but having sails of their own to assist in their propulsion when necessary. These tug-boats to be loaded with coals, and to be employed occasionally, if requisite, in towing the other vessels by steam power—two of these small steamers being intended on their arrival at their destina-

tion for active service, and one in reserve.

4. Each of the steamers to carry out a couple of well-finished balloons; one for immediate use, and the other to be in reserve, each capable of carrying at least one individual, together with all necessary apparatus for making observations, or for the exhibition of signals, and each vessel having windlasses fixed upon their decks, ropes, &c., for the purpose of enabling each balloon to be raised or lowered at pleasure; as well as apparatus for generating gas when necessary for their inflation; to prevent the too frequent repetition of which latter operation and the waste of gas, there would be no great difficulty in withdrawing the same from the balloons when not required, and compressing it by steam power or manual labour into appropriate reservoirs for future use.

5. There should also be prepared a large number of smaller balloons to carry (say) from 1 to 5 lbs. each, to serve as dispatch-carriers with appendages, as afterwards described; also a much larger number of dispatch-cases, which may be attached to coloured caoutchouc balls to render them conspicuous, and also a similar number of small grenades for producing explosive reports, and touch-string for suspending and igniting the same; also lithographic or small printing presses, Wedgwood's manifold writers, &c., for rapidly multiplying dispatches; also materials of every kind for the manufacture of balloons during the passage out, and after arrival; also several portable (Californian) dwelling-houses and cabins, for forming a commodious depôt and for storing goods, coals, &c.; also all requisite telegraphic and philosophical apparatus, particularly aërometers, for readily and accurately determining the velocity of the wind; also sledges (which might be propelled on the ice or snow by balloons, kites, &c.), as well as canister-preserved provisions, adapted for transmission by balloons.

Upon the completion of these arrangements, I propose that the expedition should proceed to some eligible position on the coasts and boundaries of the Arctic regions, and as central as possible, so as to admit of an equal range by steamboat to east and west. At that point the main depôt should be established, and as soon as possible, operations commenced, both at such depôt and at various points of the adjacent coasts, by means of the steamers. These operations to consist, in the first place, of brilliant night signals exhibited from the cars of balloons, which could be seen in a clear atmosphere at a vast distance (indeed, much further than signals by day), accompanied with the firing of guns (in favourable states of wind), fireworks, &c., so as, if possible, to obtain return signals from Sir J. Franklin's party. Should, however, all attempts of this description fail—which I can scarcely suppose possible, if the whole or any of the party still exist—I then propose, by means of the dispatch-carriers afterwards described, to precipitate in every direction over these regions, at short distances from each other, several thousand balls or cases, painted of various colours, containing dispatches and instructions to Sir J. Franklin and his party, and also numerous other such dispatches, with small ready-filled balloons attached thereto, and other cases containing pencils and paper, to facilitate the transmission of return dispatches from any of the party, wherever situate, on the first favourable state of the wind to reach any of the persons in search of them, so as to obtain from the parties themselves the particulars of their precise position, which, when once ascertained, the direction and distance might be readily computed, and a regular communication opened, and even provisions transmitted by balloon-carriers of larger dimensions, (say to carry canisters of 10 or 20 lbs. each,) which could be forwarded in succession, and caused to descend gradually, either by causing part of the gas to escape or by using two balloons, and detaching the uppermost, or by parachute, which could easily be effected by noticing the direction and velocity of the wind, and the time at which descent should take place, which might be determined and carried out with sufficient accuracy by the method afterwards described, which I have already, upon a small scale, experimentally proved to succeed. Perhaps I may here be allowed to state, that upon the first blush of this matter, I thought of employing chronometers in connection with a movement similar to the striking part of a clock for putting an alarum into

action, to attain the twofold object of releasing the dispatch balls at any given period of time, and of igniting the grenades, as afterwards mentioned, by percussion caps; but the expense of such a method presented an almost insuperable objection to my scheme; in sketching out which by candle-light, it immediately occurred to me that a common well-made candle might be made to answer such purposes very completely, as follows—viz.: To each dispatch-carrier I propose to have suspended a light, tubular-shaped lantern for containing the candle (with a patent wick that will not require snuffing). On each side of this lantern I would form a series of very small holes from the top to the bottom thereof, in lines centrally opposite to each other, with a door or slide in front sufficient to enable the candle to be fixed accurately in its place, and for the insertion of fine strings or threads through such small holes as are opposite to each other, having first passed through the wick of the candle; which lid or slide, on closing the opening, should also cover such small apertures, so as to prevent any action of the wind from interfering with its uniform combustion. Now supposing, for example, I desired to send a dispatch or canister of provisions a certain distance (say 90 miles), having candles already prepared, which shall have been proved by experiment to burn out in such constructed lanterns only at a given rate, say, for instance, in four hours, and suppose the velocity of the wind moving in the proper direction to be 30 miles per hour, and that I divide the length of the candle into four equal parts, and pass the string through the wick and opposite holes in the lantern at the third-hour division thereof, and that to the ends of the string I suspend a dispatch-case or canister: then, after lighting the candle and starting the balloon, I should know for certainty that in three hours the string would be burnt through, so as to release and precipitate, as before mentioned, the dispatch ball or canister, having at that time travelled the required distance of 90 miles. I am aware that in great distances, either from slight miscalculations of the velocity of the wind or other causes, exact accuracy could not be obtained; but if provision packages could be transmitted under such circumstances within half a mile, or even a mile of their desired destination, and dispatch balls scattered around the locality, informing the parties that such packages had been forwarded, or of their intended transmission at a certain time, and by the explosion and reports from the grenades afterwards described, I think there can be no doubt of their being discovered and secured, even during twilight. With a similar intention of attracting the attention of these parties, small ropes with a series of coloured dispatch balls and streamers, might be trailed over the ice and snow by means of balloons, their velocity depending on the force of the wind, length of rope, and consequent friction, which might readily be estimated; or any length of string, with small coloured streamers attached thereto, or strong light-coloured tape might be laid on the surface in the direction of the wind, being uncoiled from reels carried and suspended under such balloons. In a similar manner, as before described, might any moderate number of dispatches be conveyed and precipitated from the same lantern (say to 40 and upwards, and weighing two ounces each) at any required distances from each other by passing an equal number of strings through the wick of the candle at proportionate lengths thereof. I propose also to have these strings impregnated with nitrate of potash, to render them slowly combustible, so as to ignite the contents of small grenades or packets of gunpowder, thereby producing a loud report at the time of their descent, by which means every chance would be afforded Sir J. Franklin's party of obtaining such dispatches, making known their position, and obtaining supplies. If, however, the means I have proposed (if carried out) should altogether fail, and if a reward of 5000*l*., or any other large amount should be offered by the Government for the discovery of those parties, either living or dead—as already suggested,—I have no doubt that many and very desperate attempts will yet be made to attain that object, in which case I should recommend that every vessel should carry out a certain number of these dispatch-carriers (which I think might be manufactured of cambric muslin, varnished, for less than ten shillings each), to afford them the means of communicating to their friends occasionally their position and requirements, so as to prevent the future occurrence of so unfortunate a catastrophe.

Having now described, and I hope detailed sufficiently, the "*modus operandi*" of my plan, I cannot but imagine that many of your readers will immediately presume the applicability to purposes of warfare of the mode herein detailed of precipitating and igniting grenades as well as to commercial and philanthropic objects. I sincerely hope, however, that so destructive a system may never be brought into operation; for let one only fancy to himself the arrival by the wind from a distance of a thousand such machines passing in parallel lines over London, Rome, or any other large town, or over a fleet of sailing vessels, and suddenly letting fall a shower of ten thousand grenades, containing explosive or inflammable substances or fluids, ignitable in a few seconds almost simultaneously in every direction; or even letting fall a similar quantity of balls or stones from a mile or upwards in height; all this I am quite satisfied could be accomplished, not only very easily, but at a very moderate outlay. This application, however, I should not have alluded to, only that I could not complete my scheme without divulging the idea, and therefore I think it better to publish to the world this latter application, so as to place all nations in an equally advantageous position, supposing that such a destructive and cowardly system of warfare were ever to be had recourse to. A similar mode of regulating the time of explosion might, I think, be advantageously employed for the blasting of rocks.—I am, Sir, &c.,

W. H. James

November 20th, 1849.

P.S.—I have very little doubt that many sober-minded people will, if they should happen to hear of this aërial proposition, set me down as a visionary schemer; but I shall willingly bear all the obloquy of such a designation, if any idea herein divulged shall be found useful in assisting to accomplish the rescue of Sir J. Franklin and his companions, or in relieving the minds of their relations and friends from the agonizing state of suspense which they have so long endured.

PUMPS.—THE BEST POSITION OF THE AIR-VESSEL.

Sir,—There exists a difference of opinion as to the best position of an air-vessel to be placed in relation to the working barrel of a pump. I find some are of opinion that the air-vessel should be immediately above—others, below the working barrel. The evil (in the present instance) sought to be remedied by the introduction of an air-vessel, is the shock experienced both at the lift and return of the bucket, but more particularly at the lift; and the question is—Where must an air-vessel be fixed, so as to be the most effectual, above or below the working barrel of the pump?

I am induced to make the inquiry through your valuable and extensively-circulated Magazine, from knowing that it will meet the observation of those best informed on the subject. I am, Sir, yours, &c.,

William W. Hulse.

Manchester, Oct. 18, 1849.

ARGAND CANDLES.—MR. CROSLEY'S.

Sir,—Being so far north, and only receiving your excellent Magazine in monthly parts, any notices which I may send are likely to be anticipated by writers more favourably situated. In looking over your Number for September 8th, I see a long list of inventions patented by Mr. Henry Crosley, of Surrey, C.E. No. 14 is a candle upon the principle of the Argand lamp, the wicks to be made hollow, and a current of air to be allowed to pass up the said hollow, and consequently through the centre of the flame. It is now about sixteen years since I amused myself constructing candles upon this plan; and certainly I obtained some which gave abundantly large and brilliant flames, consuming, however, with corresponding rapidity. Not having, as I conceived, all the apparatus and conveniences for carrying out the experiments in a satisfactory manner, I abandoned the enterprise, after recommending it to better hands. I communicated the idea to Messrs. Thomson, of Dalkeith, who are allowed to rank among the first candle manufacturers in Britain; but the circumstance, I presume, of having more certain and profitable undertakings on hand, prevented them from attempting to perfect the invention. Shortly after this, I happened to be looking over "Hebert's Encyclopædia," (at least, that is the work if my memory does not fail me,) and was gratified to find that, long before, the idea of applying the Argand principle to candles had been suggested by the celebrated Gay Lussac, and that a patent had afterwards been actually taken out by one or more gentlemen in London, I think, for carrying the thing into practical execution. Why it has never been accomplished, so as to bring such candles into common use, I am not prepared to say, but it appears to me that there are no practical difficulties which might not by skill and perseverance

be overcome. I do not mean to cast any reflections upon Mr. Crosley for bringing forward the idea as new, and taking out a patent for it. The idea may have been as original to him as to Gay Lussac, or myself; but, after all, there appears to be no great stretch of the inventive faculty necessary to transfer the principle from the flame of a lamp to that of a candle, or any other flame.

I am, Sir, yours, &c.,
D. Mackie.

Tain Royal Academy, November 22, 1849.

GRANULATION OF LEAD.

Sir,—Will you, or any of your correspondents, be kind enough to inform me the best method of reducing lead to a fine state of division; to about the same degree as that of file-dust. When lead is sawn with a carpenters's saw, the particles produced are in the state and size I am desirous of obtaining; but how to produce two or three tons of it per day in this form is the difficulty. I find when six or eight circular saws are brought to act on a pig of lead, they become clogged by the saw-dust which introduces itself between the saw, and soon impedes the operation. How rasping would succeed I am not able to say, (I mean a collection of rasps fixed in a frame,) but a single rasp worked by hand answers the purpose very well.

I am aware that melted lead may, by being agitated in a wooden box, be brought into a state of powder, but this plan cannot be adopted in a manufactory, where three or four tons are required daily.

Should any of your correspondents be able to give me the required information, I shall be very much indebted to them.

I am, Sir, yours, &c.,
I. F. E.

Swansea, July 5, 1840.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 29TH OF NOVEMBER, 1849.

Francis Edward Colegrave, Brighton, gentleman. *For improvements in the means of communicating between the passengers and guard of a railway train, or between the guard and engine driver; parts of which improvements are also applicable to working signals on railways.* Patent dated May 22, 1849.

Mr. Colegrave's invention consists—

1. In an alarum to be worked by the passengers, for the purpose of attracting the attention of the guard, and which, when modified, is applicable as a station signal.

2. In a moveable lamp or visible signal, for the purpose of indicating in which carriage his presence is required. And,

3. In an elastic flexible tube for communicating between the driver and guard.

The audible signal or alarum consists of a bell, provided with a striker, which is fixed on the top of a vertical crank rod, which is worked by several studs placed at right angles thereto on the face of a star wheel, the spindle of which carries a pinion at the opposite extremity, into which gears a toothed wheel, keyed on a spindle which carries at the other extremity a rigger wheel, over which passes an endless cord. This apparatus is inclosed in a suitable case fixed on the top of the carriage; and the endless cord passes to another rigger wheel below, to which a winch handle is attached for the passenger to turn, whereby the endless cord will set the machinery in motion, and produce a succession of taps upon the bell; the number of which may be regulated as required.

This apparatus may be used as a station bell, for small stations, by having a small with similar mechanism—except that the handle acts upon the wheel-work direct, instead of through the medium of the endless cord, and is fixed upon a suitable standard within reach of the attendant; in the case of large ones, the apparatus is fixed between two tall columns.

The visible signal consists of a lamp placed in a case, open at top, and attached by chains to counterbalance weights; a suitable casing surrounds all, and secures it outside the carriage to the top of the roof. At ordinary times the lamp is kept within the sheath by a spring, which takes into a recess formed in a vertical rod attached to the bottom of the lamp. A cord is attached to this spring, by pulling which the spring is released from the recess, which allows the counterbalance weights to act, and raise up the lamp, presenting a *visible* signal to the guard. The lamp may be brought within the sheath again by turning a winch handle. The apparatus by which the guard is enabled to communicate with the engine driver consists of a flexible tube, made in lengths, and screwed together, which extends the whole length of the train. To the end near the guard is attached a flexible air-bag, or bellows, by compressing which air will be propelled through the tube, and pass into the whistle fixed at the other end, close to the engine driver, signalising him to stop the train.

Claims.—1. A sounding apparatus, or alarum, such as described, actuated by hand labour or steam power, instead of clockwork or springs, consisting of a bell and hammer or strike, supported on a vertical shaft with two cranks, against which work two or more projections or studs on a wheel or star, or arranged around an axle worked by toothed gearing, actuated by hand labour or steam power, so as to produce a continuous suc-

cession of sounds for any length of time desired.

2. A peculiar construction and application of a visible signal for railway purposes, such as described, consisting of a moveable lamp or visible signal, moved by weights, cords, and pulleys, for communicating with the guard.

3. The application of this apparatus, in conjunction with the alarum, so as not only to attract the attention of the guard, but also to indicate to him in what carriage or compartment is the person requiring his presence.

4. The use of an apparatus for communicating between the engine driver and guard, which consists of an elastic flexible tube, composed of a coil of steel wire covered with vulcanized caoutchouc, with a whistle attached to the end near the driver, and a blowing apparatus at the other end, for driving wind or air through the tube.

Solomon Israel Da Costa, St. Helens, City of London, C. E. *For improvements in vessels for holding solids or fluids, and in machinery for manufacturing such vessels.* Patent dated May 22, 1849.

These improvements relate; firstly, to the rolling or stamping casks of sheet metal with a shoulder-piece at each end, against which a dome-shaped head fits, which is made tight by the application of an exterior ring, and brazing and soldering. The cask may be made of two or more pieces riveted together, and the bung-hole may be in the under side of the cask, near the head, in which the tap-hole is made. Secondly, to the making of hollow articles in metal, or plastic materials, in moulds or dies.

1. The mills employed for the purposes of this invention consist of a top roller, swelled out in the middle with the ends shaped so as to form the shoulder-pieces, and of less diameter than the intended cask, and of an under roller curved inwards towards the centre, to fit the upper one. A bending roller is suitably supported, opposite the space between the top and bottom rollers, and the whole driven by toothed gearing. One of the brasses of the top roller is made in the shape of a sphere, for the purpose of allowing of its being lifted up to slip off the cask when completed. Or, instead of using a bottom roller, in one piece, two half-rollers having their peripheries suitably curved inwards, may be employed. Or, a mould, one half of which is fixed, and the other moveable, by means of a screw-rod and winch handles, may be substituted for either of the preceding apparatuses. Within the mould is a roller suspended to two cranks, which are driven through the intervention of toothed gearing from a main shaft. The roller is brought uppermost when a sheet of metal is introduced, and securely held by a grip attached to the stationary half of the mould. After this the roller is made to revolve, whereby the sheet is forced into the mould, and assumes the appearance of three quarters of a cask. The mould is subsequently opened, and the cask removed, the edges of which are brought together by clamps, and riveted. Lastly; it is proposed to manufacture hexagonal casks by means of a die and stamper.

2. To produce vessels or hollow forms in metal, or some plastic material, a fixed mould with a core attached to the bottom of a screw-rod are employed. A small quantity (which experience will determine) of molten metal, or clay, &c., is placed in the bottom of the mould, and the core brought down by turning the screw rod, which will have the effect of squeezing the material up into the space between the core and mould, and also into the sunken portions of their surfaces. When it is desired to make the metal finer, or the impression sharper, the article is subjected to the action of another die in the usual manner. In the case of the article being in clay, &c., it is slipped off the core, and subsequently baked or dried.

Claims.—1. The vessels, or casks, manufactured as described, and the machinery employed therein.

2. The mode of pressing up in moulds, or dies, vessels, or hollow forms, composed of molten or semi-molten metal, so as to produce the required shape, which may again be subjected to the action of another die or dies in the usual manner, when it is required to make the metal finer or the impressions sharper.

3. The method of making vessels, hollow shapes, or forms, by pressing clays, cements, or other plastic material in a mould or die from the bottom upwards, which prevents the formation of air-bubbles, and, consequently, of holes in the plastic material; and which method does not require a disc die, as is necessary in most articles of this nature, which is held on cross pieces that raise up and separate the material from the mould as it passes through, as, for instance, in tobacco pipes.

Pierre Armand Lecomte de Fontainemoreau, South-street, Finsbury. *For certain improvements in weaving.* (A communication.) Patent dated May 22, 1849.

Claims.—1. Constructing a cylinder with moveable pegs, and the adapting thereof to supersede the use of perforated cards, or other similar means, for producing figured tissues, as before described in reference to fig. 1.

2. Constructing metallic bands provided with moveable pegs or suitable holes, either

alone or combined to form an endless chain, and the adapting thereof, in certain cases, with a cylinder, to supersede the use of the perforated cards, or other similar means, for the production of figured tissues, as before described in reference to figs. 4, 5, and 6.

3. Constructing and adapting of two or more cylinders provided with moveable pegs, to supersede the perforated cards, or other similar means, for the production of figured tissues, as before described in reference to figs. 1 and 2.

4. The employment of moveable pegs, keys, and conductors, serving as needles, in combination with upright hooks, by means of which the warp threads are raised or left stationary for the production of the pattern, as before described.

5. Certain arrangements and combinations for putting in motion the second parts, in substitution of the ordinary Jacquard machine.

6. The giving motion to the shuttle by means of a uniform force, independently of the action of the loom.

7. Winding the warp threads on two rollers, having their weight acting always on them and on the warp threads.

Andrew Crosse, Gloucester-place, New-road, Middlesex, Esq. *For improvements in tanning hides and skins, and also in dyeing fabrics and substances.* Patent dated May 24, 1849.

The patentee (the celebrated electrician, we presume), who disclaims the latter part of the title of his patent, "*and also in dyeing fabrics,*" states that his invention consists—

1. In subjecting skins or hides, for the purpose of unhairing them, to hydrosulphuret of lime, which is obtained by passing sulphuretted hydrogen through lime and water.

2. In submitting the skins or hides, during the process of tanning, to electric or galvanic effects, by placing a plate of lead and a plate of zinc on opposite sides of the pit, and connecting them by a metal strap above the level of the water. The skins are suspended in the pit for a week, in water, which is converted into ooze or tanning liquor, of a strength of 15° sacchorometer, by the addition of bark. Or, the water is removed, and ooze substituted for it. The strength of the ooze is successively increased 5° every week, until it attains 45°, when the tanning operation is completed.

Claims.—1. Subjecting skins or hides to hydrosulphuret of lime.

2. The employment of the means for producing electric or galvanic effects during the tanning of skins or hides.

Rees Reece, St. John-street, Smithfield; and Ashley Paston Price, Margate, Kent, chemist. *For improvements in the manufacture and refining of sugar and saccharine matters.* Patent dated May 24, 1849.

Claims.—1. The use of the hyposulphite of lime, the hyposulphite of magnesium, the hyposulphite of barium, the hyposulphite of strontium, either singly or in conjunction with the solutions of acid sulphate of alumina, acid acetate of alumina, or acetic acid, as defecators of sugar and saccharine matters.

2. The use of the hyposulphite of alumina as a defecator of sugar and saccharine solutions.

3. The use of the hydrosulphuret of the sulphide of magnesium, the bisulphuret of magnesium, or the sulphurets of magnesium; the hydrosulphuret of the sulphide of calcium, the bisulphuret of calcium, or the sulphurets of calcium; the hydrosulphuret of the sulphide of barium, the bisulphuret of barium, or the sulphurets of barium; the hydrosulphuret of the sulphide of strontium, the bisulphuret of strontium, or the sulphurets of strontium; as precipitants of lead or of any of the salts thereof which may be found in solutions of sugar or saccharine matters.

4. Subjecting saccharine solutions, for the purpose of removing any sulphuretted hydrogen which may exist in a free state or result from the decomposition of the sulphurets employed, to the combined action of heat, from steam or otherwise, and a vacuum, or to boiling in vacuo.

5. The use of sulphurous acid, or the hyposulphite of alumina, or the hyposulphites which when treated with an acid, or otherwise, produce or liberate sulphurous acid as a primary or secondary decomposition to remove any excess of sulphuretted hydrogen.

6. The use of saccharate of lime, saccharate of baryta, or saccharate of strontia to neutralize any acid which may be found in solutions of sugar or saccharine matters resulting from the employment of the acid sulphate of alumina or the acetate of alumina.

7. The use of saccharates of lime, of baryta, or of strontia, as the source of carbonate of lime, carbonate of baryta, or of carbonate of strontia, which are produced by passing carbonic acid gas into solutions of these saccharates, and also the application of either of the carbonates in the refining of sugar or saccharine matters.

8. The use of saccharate of lime, of baryta, of strontia, or of magnesia as a source of hydrated saccharate of calcium, of baryta, of strontia, or of magnesia, which are produced by passing hydrogen gas into

solutions of these saccharates until none of the same is absorbed, to neutralize any acid or decompose any salt which may exist in solutions of sugar or saccharine matters resulting from the employment of lead.

9. The use of bicarbonate of alumina, or bicarbonate of magnesia, as a defecator of sugar or saccharine matters.

10. The use of the soluble sulphites as defecators of sugar or saccharine matters.

11. The use of the soluble sulphites in the treatment of canes, or beetroot, for the purpose of extracting saccharine matters therefrom.

12. The use of the soluble hyposulphites in the treatment of canes, or beetroot, for the purpose of extracting saccharine matters therefrom.

THOMAS GOODFELLOW, Tunstall, Stafford, earthenware manufacturer, and GEORGE GOODFELLOW, Shelton, in the same county, potter. *For improvements in the method or methods of preparing plastic materials for manufacturing purposes.* Patent dated May 24, 1849.

Claims.—The preparation of materials by employment of superincumbent atmospheric pressure, to press out, separate, or discharge water and moisture therefrom, according to the methods described in the specification.

2. The mixture of clay or marl with combustible substances, in order to the manufacturing thereof into porous articles

[The details of this invention will be given in an early number.]

ANDREW SMITH, St. James, Westminster, engineer. *For improvements in machinery for, or methods of manufacturing rope or cordage, and improved modes of fitting and using the same.* Patent dated May 24, 1849.

For specification and claims, see *ante*, p. 516.

FREDERICK STEINER, Hyndburn, Accrington, Lancashire, Turkey-red dyer. *For improved processes and apparatus to be used in the Turkey-red dye on cotton and its fabrics.* Patent dated May 24, 1849.

These improvements relate—

1. To a frame for stretching two pieces of woven fabric, between which the cotton, wool, or yarn, or cotton fabric is placed, in order to prevent injury thereto from handling during the processes of dyeing, washing, and brightening.

2. To an arrangement of apparatus whereby the cotton is subjected to each of the before-mentioned processes, without the necessity of their being removed, or even touched during the operation. And

3. To an arrangement of apparatus in connection with the drying stove, to facilitate the cotton being placed in or withdrawn from it, and also to regulate its degree of dryness.

1. The stretching apparatus consists of a framework, carrying at one end a supply-roller, round which one of the pieces of woven fabric is wound, and at the other end, but at right angles to the first, a second supply-roller, with the second piece of woven fabric wound upon it. At the end of the frame, opposite to the first supply-roller, there is placed a receiving-roller, and above each of them is a small anti-friction roller, over which the woven fabric is led from the first supply-roller, and attached to the receiving one. The other piece of woven fabric is brought to bear against that upon the second anti-friction roller, and is also made fast to the receiver, so that on the revolution of this last, by means of a winch-handle adapted to its axis, the two pieces of woven fabric will be wound thereon. The two supply and receiving rollers are furnished with weighted levers, which may be made to act upon them as occasion may require, for the purpose of retarding their revolutions, and consequently stretching the fabrics. The *modus operandi* is as follows:—The fabrics, being wound upon their respective rollers (on which the weighted levers are made to act), and attached to the receiver, rotary motion is communicated to this latter, while the cotton, wool, yarn, or fabricis placed upon the woven fabric between the anti-friction rollers, and thereby wound upon the receiver between the two fabrics. When this operation is completed, the first supply-roller is relieved from the weighted lever, and the second piece of cloth is taken off its roller, and, passing over the anti friction rollers, is attached to the first. A weighted lever is applied to the receiving roller, and rotary motion communicated to the first supply roller, whereby the two pieces of woven fabric, with the cotton between them, will be drawn over the two anti-friction rollers previously to their being wound upon it, and while in that position are stitched together.

2. It is proposed to employ a framework, carrying two horizontal rows of rollers suspended in the dye vat. The top rollers are furnished with tooth wheels upon their axes, and with intermediate pinions, whereby the roiary motion imparted to the first (the axle of which passes through a stuffing-box in the side of the vat) is communicated to the entire series. The dye vat is closed at top, and provided with a safety-valve, while a steam supply pipe and a waste cock are adapted to the bottom. The two fabrics (stitched together with the cotton between) are passed over the first top roller and under the first bottom roller, and so on to the last. The vat is filled with dye liquor, the steam turned on, and the material passed through it by reason of the rotary motion of the

rollers. When the material is dyed deep enough, the liquor is run off, and its place supplied with water, through which the fabrics and cotton are passed, as before, upon the rollers, to wash them. Lastly, the water is replaced by a brightening liquor, heated by a fire underneath the vat, and the cotton run through it as in the two preceding cases. The washing and brightening processes are repeated alternately until the cotton has attained the requisite degree of brightness.

3. The drying stove consists of a chamber with a perforated floor, through which the heated air is made to pass, and furnished with a top and bottom row of rollers, round which the fabric is passed as in the preceding case. On one side of the stove is a chamber, which contains the fabrics to supply the stove and receives them when dried. In the top of this chamber is a large wooden drum, which receives rotary motion from the prime mover and communicates it by means of bevel wheels and an inclined rod to the first of the top rollers, whence it passes by the intervention of locked gearing throughout the whole of that row to the last roller, which communicates it by bevel wheels and an inclined rod to three carrying rollers suspended above the top row. The fabrics are led over the top and under the bottom rollers and along the top of the carriersout of the stove to between the wooden drum, and a roller placed above, whence it passes through a folding apparatus to the bottom of the chamber. The speed of the fabrics through the stove may be regulated according to the degree of dryness desired to be obtained.

Claims.—1. Stretching, between two pieces of woven fabric cotton, either in the state of wool or yarn, or in any of the intermediate stages, or in such of its fabrics as cannot be so advantageously operated upon in the ordinary manner.

2. The apparatus described under the second head, when used in all or any of the processes of dyeing, washing and brightening cotton in Turkey-red dyeing.

3. The processes and apparatus for suspending cotton in a stove for heating and drying it, in which it may be moved and withdrawn as required.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Francis Justin Duburguet, of Cahors, France, for certain improvements in hydro-pneumatic engines. November 22; six months.

Joseph Pierre Gillard, gentleman, of Paris, France, for certain improvements in the production of heat, and light in general. November 22; six months.

William Garnett Taylor, of Burton House-hall, Westmoreland, gentleman, for improvements in lint and linting machines. November 24; six months.

George Calloway of Putney, Surrey, station agent; and Robert Alleé Purkis, of the same place, engineer, for certain improvements in propelling ships and other vessels, also in apparatus for ploughing land. November 24; six months.

Charles Cowper, of Southampton - buildings, Chancery-lane, for certain improvements in piling, fagotting, and forging iron for plates, bars, shafts, axles, tyres, cannons, anchors, and other similar purposes. November 24; six months.

Joseph Barrow, of St. Paul's, Deptford, Kent, engineer, for improvements in axles and axle-boxes of locomotive engines and other railway carriages. November 24; six months.

Ambroise Ador, of Paris, France, engineer, for improvements in producing light. November 24; six months.

Henry Lamplough, of Snow-hill, consulting chemist, for a new mode of supplying pure water to cities and towns. November 24; six months.

Frank Clarke Hills, of Deptford, Kent, manufacturing chemist, for an improved mode of compressing peat for making fuel or gas, and of manufacturing gas, and of obtaining certain substances applicable to purifying the same. November 24; six months.

Francis Tongue Rufford, of Prescot-house, Worcester, fire-brick manufacturer; Isaac Marson, of Cradley, in the same county, potter; and John Finch, of Pickard-street, City-road, Middlesex, manufacturer, for improvements in the manufacture of baths and wash-tubs, or wash vessels. November 24; six months.

James George Newey, and James Newman, of Birmingham, for improvements in the manufacture of button studs, and other dress fastenings and ornaments. November 28; six months.

Charles Barlow, of Chancery-lane, London, for improvements in the manufacture of a certain pigment. (Being a communication.) November 29; six months.

Louis Napoleon Le Gras, of Paris, France, civil engineer, for improvements in the separation and disinfection of fecal matters, in the manufacture of manure, and in the apparatus employed therein. November 30; six months.

LIST OF SCOTCH PATENTS FROM THE 22ND OF OCTOBER TO THE 22ND OF NOVEMBER, 1849.

Alexander Parkes, of Harborne, Stafford, chemist, for improvements in the deposition and manufacture of certain metals. and alloys of metals. and improved mode of treating and working certain metals, and alloys of metals, and in the application of the same to various useful purposes. Sealed, October 24; six months.

Conrad William Finzel, of the city and county of Bristol, sugar refiner, for improvements in processes and machinery employed in and applicable to the manufacture of sugar. October 24; six months.

William Edward Newton, Chancery-lane, Middlesex, C.E., for improvements in machinery for planeing, tongueing, and grooving boards or planks. (Communication.) Oct. 24; six months.

David Owen Edwards, of Sydney-place, Brompton, Middlesex, surgeon, for improvements in the application of gas for producing and radiating heat. October 24; six months.

John Mercer, of Oakenshaw, Lancaster, and William Blythe, of Holland Bank, Oswald Hoistle, in the same county, manufacturing chemist, for improvements in certain materials to be used in the processes of dyeing and printing. October 31; six months.

William Henry Ritchie, of Brixton. Surrey. gent., for improvements in fire-arms. October 31; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for certain improvements in the manufacture of sugar. (Communication.) November 2; six months.

Joseph Lowe, of Salford, Lancaster, surveyor, for certain improvements in grates or grids, applicable to sewers, drains, and other similar purposes. November 2; six months.

John Holt, of Todmorden, Lancaster, Manager of the Waterside Works, for improvements in machinery or apparatus for preparing cotton and other fibrous substances, parts of which improvements are applicable to machinery used in weighing. November 5; six months.

William Buckwell, of the Artificial Granite Works, Battersea, Surrey, C. E., for improvements in compressing and solidifying fuel. November 5; six months.

Thomas John Knowlys, of Heysham Tower, near Lancaster, esq., for improvements in the application and combination of mineral and vegetable products, also in obtaining products from mineral and vegetable substances, and in the generation and application of heat. November 5; six months.

Henry Crosley, of the firm of Henry Crosley, Son, and Galsworthy, of Emerson-street, Surrey, engineer and coppersmith, for certain improved modes or methods of, and apparatus for heating and lighting, for drying substances, and for employing air in a warm and cold state, for manufacturing purposes. November 7; six months.

Henry Knight, of Birmingham, Warwick, for certain improvements in apparatus for printing, embossing, pressing, and perforating. November 12; six months.

Adam Yule, of Dundee, master mariner, and John Chanter, of Lloyds, London, and Arnold Terrace, Bromley, Middlesex, gent., for improvements in the preparation of materials for coating ships, and other vessels. November 14; six months.

John Parkinson, of Bury, Lancaster, brass founder, for improvements in machinery or apparatus for measuring and registering the flow of liquids. November 14; six months.

Alexander M'Dougall, of Longsight, Lancaster, chemist, for improvements in recovering useful products from the water used for washing, and in treating wool, woollen and cotton fabrics, and other substances. November 14; six months.

Peter William Barlow, of Blackheath, Kent, C.E., for improvements in parts of the permanent ways of railways. November 14; six months.

George Edmund Donisthorpe, and John Whitehead, of Leeds, manufacturers, for improvements in preparing, combing, and heckling fibrous matters November 16; six months.

Walter Crum, of Thornleibank, Renfrew, in Scotland, calico printer, for certain improvements in the finishing of woven fabrics. November 16; six months.

Alfred Barlow, of Friday-street, London, warehouseman, for certain improvements in weaving. November 19; six months.

Charles Edward Amos, of the Grove, Southwark, Surrey, engineer, and Moses Clark, of St. Mary's Cray, Kent, engineer, for improvements in the manufacture of paper, and in the apparatus and machinery used therein; part of which apparatus and machinery is applicable for regulating the pressure of liquids, for various useful purposes. November 21; six months.

Joshua Proctor Westhead, of Manchester, manufacturer, for improvements in the manufacture of fur into fabrics. November 21; six months.

LIST OF IRISH PATENTS FROM THE 21ST OF OCTOBER, TO THE 22ND OF NOVEMBER, 1849.

Thomas Beale Browne, of Hampen, Gloucester, gent., for certain improvements in looms, and in the manufacture of woven and worsted fabrics. October 22.

John Goodier, of Mode-wheel, Manchester, Lancaster, miller, for certain improvements in mills for grinding wheat and other grain. October 22.

William Edmond Newton, Chancery-lane, Middlesex, civil engineer, for certain improvements in steam boilers. (Communicated.) November 6.

Pierre Armand Lecomte de Fontainemoreau, of No. 4, South-street, Finsbury, for certain improvements in weaving. (Communicated.) November 22

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Nov. 22	2093	Reynolds and Tillcocks	New Bond-street	Ladies' haut-ton vesture.
23	2094	Thomas Melling	Rainhill Iron Works, near Liverpool	Game register.
,,	2095	Lewis Le Richeux	Homerton	Spring for a spring neckcloth.
,,	2096	Gilbert Dickenson	New Bond-street	Comprehensive drawing folio.
,,	2097	J. and J. Holmes	Regent-street	Manifold cloak.
24	2098	Francis Birkin Newton	Manchester	The Newton coat without seam.
27	2099	William Burgess	Blackfriars-road	Gutta percha hose joint.
28	2100	Francis Klamm	York-street, Commercial-road East	Rotary heel tip.
29	2101	William Murray	University-street	Compensating ball-lever.

GUTTA PERCHA.

HANCOCK AND CO. solicit attention to their very superior manufactures in GUTTA PERCHA, &c., which they continue to supply on their usual advantageous terms, having secured an unlimited quantity of the new material previously to the late speculations in the market. As LICENSEES UNDER THE FIRST PATENT granted for the manufacture of Gutta Percha, they further beg to inform their Correspondents that with regard to any dealings had with H. and Co., for goods manufactured by them under their License, they are ready to hold al their customers harmless and indemnified from any proceedings which may be threatened to be taken against them, by ANY PARTIES assuming to be Patentees under subsequent Patents; the only stipulation on the part of H. and Co. being, that they and their Solicitor shall have the conduct of any defence that may be considered necessary.

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GOODFELLOW'S PATENT IMPROVEMENTS IN THE PREPARATION OF PLASTIC MATERIALS.

Fig. 1.

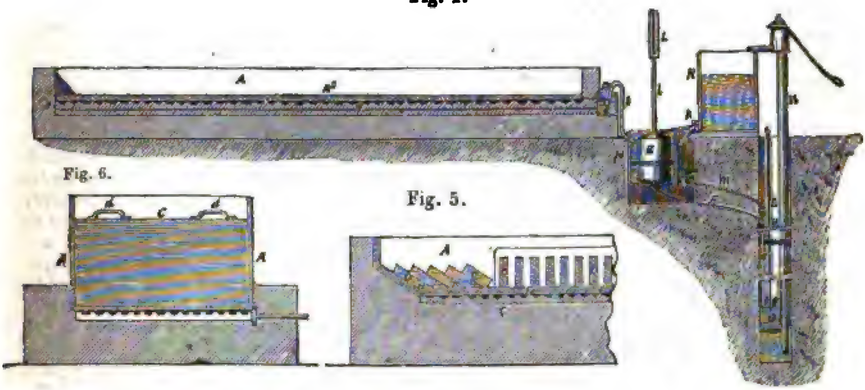
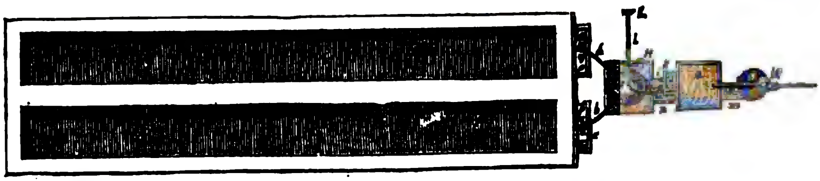


Fig. 6. Fig. 5.

Fig. 1a.



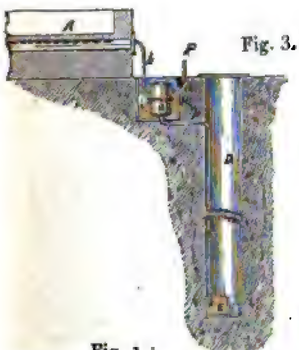


Fig. 3.

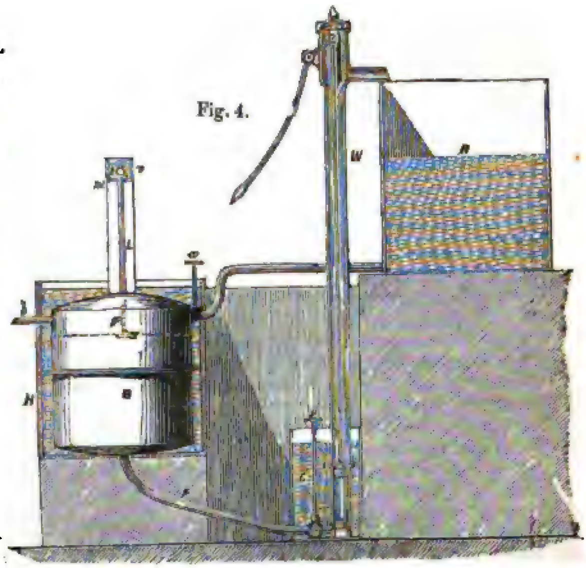
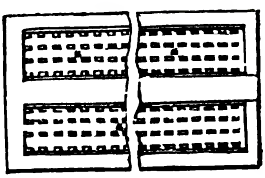


Fig. 4.

Fig 1.b



GOODFELLOW'S PATENT IMPROVEMENTS IN THE PREPARATION OF PLASTIC MATERIALS.

(Patent dated May 24, 1849. Patentees, Thomas Goodfellow, of Tunstall, Earthenware Manufacturer, and George Goodfellow, of Shelton, Potter.)

The object of the improvements embraced under this patent is twofold:—*First*, to press out, separate, or discharge from the crude or raw materials of various manufactures, either wholly or partially, the aqueous matters with which they may be charged more expeditiously and economically than is done by the processes heretofore in use. And, *second*, to prepare certain materials by an artificial and temporary combination therewith of certain combustible substances, for the manufacture of wares possessing various degrees of porosity.

The first branch of these improvements is carried into effect by six several methods or processes, which are thus described:—

First Method.

The principle on which this method is founded, is the production, by hydrostatic agency, of a partial vacuum under the material to be operated on, and the consequent action of the superincumbent atmosphere upon it.

An exemplification of this method, as applied to materials employed in the manufacture of pottery, is given in figs. 1, 1^a, and 1^b of the accompanying engravings Fig. 1 being a longitudinal elevation, partly in section, of the arrangements necessary for the purpose; fig. 1^a, a ground plan thereof; and fig. 1^b a plan on the line *yz*. A, is a slip kiln, pan, or trough, which is mounted on a firm basement of brickwork; it is open (as usual) at top, and lined at bottom with sheet lead, sheet gutta percha, or other suitable air and water-tight material. A^2 is a false bottom to the kiln, pan, or trough, of porous tiles, laid transversely on the top of a series of concave tiles, *a a*, which rest on the real bottom, but do not reach quite up to the wall on either side, so that the hollows of these tiles, together with the open-air spaces around them, form one continuous chamber, by the exhaustion of which, in the manner afterwards shown, the required vacuum under the slip is produced. B, is an air-vessel, which is set in a stone cistern, H, and surrounded with water, in order the better to keep it air-tight; which air-vessel (B) communicates; *firstly*, with the vacuum chamber, *a a*, under the false bottom, A^2, by means of a pipe, *b*, which passes through a small ante-chamber, P, open at top; *secondly*, with a water cistern, R, placed above the level of the vacuum chamber, *a a*, by means of a pipe, *r*, which passes through an open ante-chamber, K (similar to P); *thirdly*, by a pipe, *i*, with the ante-chamber, K; *fourthly*, by a pipe, *l*, with a barometric gauge, L; and, *fifthly*, with the well, D, by a discharge pipe, F, which dips at its lower end into a bucket, E, kept filled with water, and is opened and shut by a tap, *e*. W, is a common pump affixed to the top of the well, D, and G *g*, a weighted rod by which the tap is worked; *m*, is a pipe, with tap, *n*, by which the water in the stone cistern, H, can be let off when required; *q*, is a tap on the pipe, *b*, by which the communication is opened or shut off between the vacuum chamber, *a a*, and air-vessel, B; *t*, is a tap on the pipe, *r*, by the opening of which water is allowed to flow into the air-vessel, B, and thence into the vacuum chamber, *a a*; *u*, is a tap on the pipe, *i*, by the opening of which the air, as it is expelled from B, makes its escape; and *s*, a tap affixed to the exhaust end of the vacuum chamber, by opening of which the air is allowed to escape from the air chamber, *a a*. The taps, *q* and *s*, are inclosed within the ante-chamber, P, and the taps, *t* and *u*, within the ante-chamber, K; and these ante-chambers are kept constantly filled with water to a little height above the taps in each, whereby the possibility of any air getting in through these taps to impair the vacuum in the vessel, B, is prevented; while at the same time the water presents no material obstacle to the forcible extrusion of air through the taps, *s* and *u* (both of the chambers, P and K, being, as before stated, left open at top.) The operation of the apparatus is as follows:—The kiln, pan, or trough, A, being filled with clay slip, and the cistern, R, filled with water by the pump, W, the tap, *e*, at the bottom of the pipe, F, is closed by raising the weighted rod, G *g*. The four taps, *s*, *q*, *t*, and *u*, are next opened, whereupon the water flows from the cistern, R, down into the air-vessel, B, driving the air out of it through the pipe, *i*, and tap, *u*. As soon as the vessel, B, is filled, the water proceeds up the pipe, *b*, and fills the vacuum chamber, *a a*, expelling the air from it through the tap, *s*. When the water has thus entirely displaced the air in the vessel, B, and vacuum chamber, *a a*, which will be at once evidenced by a perceptible rise of the water in the ante-chambers, K and P (the water having then no other outlet), the four taps, *s*, *q*, *t*, and *u*, are shut. The tap, *e*, is then opened by letting fall the rod, G *g*, on which the water in the air-vessel, B, descends

by its own weight down the pipe, F, into the bucket, E, from which it flows over into the well, D, followed instantly after by the water in the exhaust chamber, *aa*, beneath the false bottom of the kiln, pan, or trough.

Fig. 2.

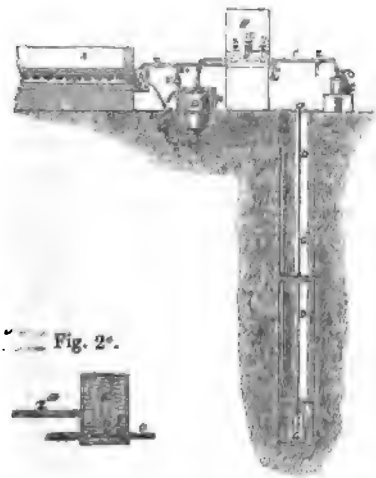


Fig. 2^a.

A vacuum more or less perfect is thus produced in the vessel, B, and chamber, *a a*, when the pressure of the external atmosphere being thereby brought to act upon the slip with a force proportionate to the degree of the exhaustion beneath, the water or moisture in the materials is forced through the porous tiles of the false bottom, A^2, into the chamber, *a*, whence it flows off through B into the well, D. The state of the vacuum in B and *a a* may always be ascertained by inspection of the gauge, L.

Second Method.

According to this method the water or moisture is discharged from materials employed in the manufacture of pottery by atmospheric pressure, in the same way as in the preceding case; but the requisite exhaustion beneath the materials is obtained by the agency of steam. In fig. 2, we have shown the modifications which would be requisite in the arrangement represented in figs. 1^a and 1^b, and before described, in order to the substitution of this method of exhaustion. A, B, D, F, H, P, R, *q l*, *i*, are all parts precisely similar to those indicated by the same letters in fig. 1. C^b is a steam boiler; *c*, a pipe, which leads from the boiler through a small water cistern, *w*, placed by the side of the large cistern, R, and terminates in the air-vessel, B; *m*, is a tap, by which the small cistern, *w*, is filled from the large cistern, R; *y*, a tap affixed to a short branch pipe, which leads from the pipe *c*, into the large cistern R, (as is more clearly shown in the ground plan of R, given separately in fig. 2^a), by the opening of which, tap *y*, water is supplied to the boiler, C; *x* and *z*, are two other taps on the pipe *c*, by which the communication between the boiler, C, and air-vessel, B, is opened or shut: *h* is a tap, by which the cistern, *w*, may be emptied when required; z^a is a pipe with tap *d*, by which the antechamber P, at the exhaust end of the kiln pan or trough, is supplied with water; H^a is a water cistern, which is supplied by a branch-pipe z^b (having a tap *v*), from the pipe, z^a, and contains a condenser, O, which communicates on one side by a pipe, *g*, with the air-vessel B, and on the other, by the pipe *l*, with the exhaust-chamber, *a a*, of the kiln pan or trough; g^a is a tap to the pipe *g*, and *q*, a tap to the pipe, *l*; *n* is a pipe by which the water in the vessel, O, may be discharged into the pipe, F, and thence into the well D; G is a bucket, which is moved up and down the frame-work, N, by a rod, G^a. The mode of working with this apparatus is as follows:—The tap, *d* on the pipe, z^a, is first opened, which fills the ante-chamber, P, and through that, the exhaust-chamber, *a a*, under the false bottom of the kiln pan or trough, with water (the tap *q*, which commands the communication between, *a a*, and the condenser, O, being at this time closed). The taps, *x*, *z*, and g^a, are next opened, which allows the steam to flow from the boiler, C, along the pipe into the air-vessel, B, and condenser, O, driving the air before it, down the pipes, *n* and F, into the well D. While the steam is still rushing through, the bucket, G, is drawn up by the rod, G^a, so that the bottom end of the discharge-pipe, F, may dip into the water in the bucket, and as soon as the air is all expelled from the vessels, B and O, the taps *x* and *z* are shut. The cistern, *w*, is now filled with water (by the tap *m*), and the portion of the pipe, *c*, between *x* and *z*, also filled with water by turning the tap *y*, in order that any subsequent access of air through the pipe, *c*, to the vessel, B, by the pipe, *c*, may be prevented. The cistern, H^a, containing the condenser, O, is now filled with cold water by turning the tap, *v*, of the branch pipe, z^b, and the tap, *q*, opened, whereupon the steam in B and O becomes in a few minutes condensed (the water of condensation passing off through the pipes, *n* and F, into the well D), and the water in the exhaust-chamber, *aa*, of the kiln, pan, or trough rushing into the void thereby occasioned, a vacuum is also produced in that chamber, which brings the atmospheric pressure into

play on the surface of the materials, as in the plan first described.

Third Method.

By this method the vacuum under materials employed in the manufacture of pottery is obtained by means of an air-pump, in the manner represented in fig. 3. A, B, D, E, F, H, *b*, and *s*, are parts similar to those indicated by the same letters in figs. 1, 1[a], and 1[b]. P is a pipe which connects the air-vessel, B, with an air-pump, which may be of any suitable form or size, and may be either worked by hand or by machinery. The air in the exhaust-chamber, *a a*, of the kiln, pan, or trough, in the vessel, B, and pipe, F, is pumped out by the direct action of the air-pump, whereupon the atmospheric pressure acts on the slip (or the materials) to be operated on as before.

Fourth Method.

The displacement of the air under materials employed in the manufacture of pottery is effected according to this method by means of a lifting pump, which does away with the necessity for the deep well required by the three preceding methods. The details peculiar to this method are exhibited in fig. 4. B, is an air-vessel inclosed in a water cistern, H, and communicating by a pipe, *b*, with the exhaust chamber of a slip trough (or other vessel containing materials in a moist state), all as in figs. 1, 1[a], and 1[b]. R, is a water cistern which is placed above the level of B. *r*, is a pipe which connects B and R, and is furnished with a tap, *a*. F, is a pipe which leads from the bottom of B to the bottom of the lift pump, W; and *v*, a tap to that pipe. C, is a water cistern, in which the lifting pump is placed to prevent any access of air through the valve, *v*, to the vessel, B. L, is a glass tube which is mounted in a framework on the top of the vessel, B, and communicates therewith. P, is a float to indicate the height of the water in the vessel, B (when admitted thereto), the stalk of which float moves up and down within the glass tube, L; *n*, is a small cistern of water which closes in the glass tube at top, but is itself open at top and contains a tap, *t*, which communicates through the bottom, *m*, with the interior of the tube, L. The mode of operating with this apparatus is as follows :—The tap, *a*, is first opened, in order to fill the air vessel, B, from the cistern, R, and then the tap, *t*, which allows the air expelled from B, to escape up the glass tube, L, and thence into the atmosphere. When the vessel, B, is filled, which will be seen by the rise of the stalk of the float in the glass, the taps, *a* and *t*, are closed. The tap, *v*, which commands the communication between B and the bottom of the lift pump, W, is now opened, and the pump set to work to pump out the water from B, and the connecting tube, F; which being effected, produces, of course, a vacuum in the vessel, B, and in the exhaust chamber, *a*, of the kiln, pan, or trough, with which it communicates. The tap, *v*, is then closed.

Fifth Method.

As the most perfect vacuum which can be obtained by any of the preceding methods, or, in other words, the greatest atmospheric pressure which can be produced on the materials operated on cannot exceed 15 lbs. per square inch, and as we find that that pressure when exerted upon the materials in one large and undivided mass of any considerable depth, is insufficient to express the water or moisture from some close clays to the extent, and with the dispatch desirable, we make up for that deficiency in the expressing power, by increasing the quantity and activity of the absorbent surfaces in the manner exemplified in fig. 5. A, is a kiln pan or trough; *b*, a false bottom of porous tiles; *a a*, a series of concave tiles, the hollows in which form, with the open spaces around them, an exhaust chamber; and *c*, an air and water-tight bottom, all as in fig. 1. D D, are a series of upright porous tiles, which are loose or hinged to the false bottom, *b*, in order that they may be thrown back into the position represented at *m*, when the exhausting process has been completed, and it is requisite to remove the materials (reduced then to a proper consistency) from off the sides of these upright tiles. The amount of absorbent surface may be also increased by making the false bottom, *b*, of a corrugated form, but not to the same extent as by the hinged or loose upright tiles, which we therefore prefer. The addition of these tiles, D D, may be made to any of the four several arrangements or methods before described.

Sixth Method.

Some materials, as sugar, boracic acid, &c., are of so porous a nature, that on the pressure of the atmosphere being applied to free them from moisture, much of the air is forced between and past the aqueous particles, without contributing to the desiccating result desired. In such cases, we construct the containing vessel in the manner represented in fig. 6. A, is the containing vessel, which is mounted on a basement of brickwork, and provided with an exhaust chamber at bottom, in the same way as in fig. 1. C, is a close cover, which is placed on the top of the materials, and pro-

vided with handles, *d d*, by which it may be lifted off when required. The atmospheric pressure being intercepted by the cover, C, acts through that cover by its total columnar weight on the materials, instead of by permeation through them, as in the preceding arrangements; and whether the materials are more or less porous becomes therefore a matter of indifference. When sugar, or any other material of a like granulous nature, is operated upon, the exhaustion is effected by means of the first, or second, or fourth of the methods before described; and when boracic acid is the material to be operated upon, the exhaustion is effected by means of the first, second, third, or fourth methods.

The second branch of the patent has reference more particularly to the manufacture of such porous articles as potters' moulds and saggers, chemical filters, flower-pot soakers, &c. The mode of preparing the materials for these articles is as follows:—

We first reduce clay or marl, by mixture with water and trituration, to a soft state, and then mix intimately therewith pounded coke, or charcoal, or coal-dust, or sawdust, or soot, or some other combustible substance, in proportions more or less, according as more or less porosity is desired to be produced. The water is then expelled from this compound by any of the processes before described, after which it is moulded, in the usual way, into the tiles, moulds, saggers, or other porous articles aforesaid. The articles are finally subjected to a strong heat in an oven, when so much of the ingredients of the compound as are of a combustible nature, or at least the greater portion thereof, burn away, and leave only a hard porous substance or body behind. The greater the proportion of combustible matter thus burnt out, the more porous, of course, the articles will be; but the finer, also, the combustible ingredients are, the smaller and more numerous will the porosities be. Where, therefore, it is desirable to combine a high degree of porosity with great minuteness in the interstices, as in water filters, potters' moulds, and flower-pot soakers, the finest sorts of combustible materials only should be used, as charcoal or soot, and these as well pounded as may be.

SUMMARY OF THE EVIDENCE AND ARGUMENTS FOR AND AGAINST VERTICAL BREAKWATERS.

Much as the sea-wall and breakwater questions have been discussed, it does not seem that the arguments and evidence adduced have as yet been brought together in a concise form, so as to serve for general reference, particularly in relation to the long slope or the vertical wall; the present communication is an attempt to abstract the most prominent facts and arguments on both sides of the question, bringing them into comparison for general information, and so as to diminish the labour of recurring to voluminous and costly works. The many papers that have appeared in the *Mechanics' Magazine*, valuable as most of them are, can easily be referred to by means of the index, so that it seems needless to abstract them, especially as the Reports of the Commissions on Harbours of Refuge, and Sir John Rennie's account of the breakwater in Plymouth Sound, contain the most important information. These publications accordingly are selected as the basis of the present abstract; but, besides these works, some use will be made of a few official documents hitherto not publicly known, but which are relevant to the vertical wall.

Articles in the *Mechanics' Magazine* have already exhibited that the Commission on the Harbour of Refuge at Dover reported in favour of an upright wall for its protection, and that Sir Howard Douglas and Sir William Symonds protested against this form of breakwater.

As to the recommendation of the Commissioners, of an upright wall for Dover Harbour, it seems that one important circumstance, which had much influence with them, has been entirely lost sight of in all discussions on the subject; namely, to use the words of their Report, "At both the above-mentioned places (Cherbourg and Plymouth) the breakwaters stand in deep bays; but on referring to the chart at Dover, it will be seen how slightly that bay is indented, and that a work there constructed, with a long slope, by dropping masses of stone into the sea, will amount to the formation of an artificial reef of rocks, *and occasion a bed of breakers extending into the fair way of the channel.*"

The probability of such an injury to the channel, seems of itself, without other considerations, reason amply sufficient to justify their decision as to this particular harbour.

Taking in a general point of view

the question as to whether a sea-wall be the more stable if vertical, or if a long slope, the majority of the Commissioners were decidedly in favour of the upright wall; but others of them, who were advocates for the long slope, are so very eminent for professional and scientific skill, that their opinions cannot fail of having great weight in general estimation. Both parties refer to the breakwaters at Cherbourg and in Plymouth Sound, as evidence in favour of their respective but dissimilar opinions; these works, then, and the evidence respecting them, must necessarily hold a prominent place in this abstract.

Sir Byam Martin, in his examination of Mr. Cubitt, said, "You are, no doubt, aware of the tremendous disasters that attended the long slope at Plymouth during its progress of construction, and that on two occasions the whole of the slope may be said to have been completely upset; that, on one occasion, 200 yards in length, and 30 in width, of the upper stratum of the finished part had been displaced by the violence of the sea, and the whole carried over the breakwater itself, and lodged inside; that, seven years after that, in 1824, the large blocks of the slope on the sea-side were carried entirely over the surface, a distance of 138 feet, and piled up on the inner or land-side, and that nearly 200,000 tons of stone were removed on that night, and piled up on the inner or land-side?"

Mr. T. M. Rendel, in his examination, speaking of the Plymouth Breakwater, said, "The slope forms an inclined plane, up which the sea is able to roll the large blocks of stone which forms what is called the fore-shore, and to throw them on the land-side." "In all cases of sloping breakwaters that I have observed it is not the upward action of the wave only that does damage to the slope; the *recoil* of the wave is almost as injurious."

The *recoil*, it may be observed, could not injure an upright wall.

Captain James Vetch, R.E., said, in his examination, "Since I had the honour of being before you last year, I have seen the breakwater at Plymouth repeatedly, I have observed the sea roll over that breakwater from end to end near the time of high water; and on the 19th of January last, I saw some waves break over at *low* water; and I think that such a breakwater would be very unfit for such a position as Dover. I heard also (what seemed to be notorious) that a vessel of 200 tons burden was actually borne by a wave over the summit of that breakwater. I may add, in respect to the Plymouth breakwater, that the crest is only elevated about 18 inches above high-water mark, and the whole length of the causeway is not only without shelter or protection, but it has been made as smooth as possible to avoid all obstruction to the passage of the waves, and to which disposition, as a sloping breakwater, it owes its stability. All attempts to construct a breast-wall at the top of the sea slope failed; immense blocks of stone, secured with iron bolts and straps, were carried away, and no attempt dare now be made to repeat these experiments."

Captain Washington, in his evidence relating to the harbour at Cherbourg, said, that the action of the waves was terrific near the surface of the long slope there, that it "causes a jet of water 90 feet in height;" but that that action does not appear to extend lower than from 18 to 20 feet below low water, as the small stones there remain unmoved.

Mr. Rendel was asked, "Do you think that Cherbourgh and Plymouth may be regarded as successful experiments?" To which he replied, "They have afforded profitable experience; but I regard them rather as *beacons* than examples."

"Beacons," indicating a mode to be avoided.

The Commissioners in their Report bring forward, as examples of failures of the long slope, "A communication recently made to us by the Lords Commissioners of the Admiralty," observing, that it "exhibits an instructive catalogue of the present state of the harbours on the coast of Ireland constructed with a long slope."

The Commissioners do not specify by whom the harbours in question were designed; but as Captain Washington afforded this information, the names of the engineers who planned them are in each instance added from the Report on Dover Harbour:

"At Kingstown, the foreshore of the eastern pier has required constant and heavy repairs, and is still insecure."—Engineer, Mr. Rennie.

"Ardglass Pier, built in 1829, of large rubble stone, with a long slope, now lies, together with its lighthouse, a mass of ruins in the sea."—Engineer, Rennie.

"Donaghadee Pier, constructed in 1820, of rubble stone, with a long sea-slope, has had its glacis torn up by south-easterly gales, and a part of the materials carried half across the harbour's mouth."—Engineer, Rennie.

"Portrush Pier, constructed in 1826, of large rubble stone, with a long slope, was found to be so much damaged in 1844, that the engineer called upon to examine it reported that 4,000 tons of materials had been washed from the outer extremity of the slope round the pier-head, and had formed an artificial reef 70 feet in length, rising three feet above low water."—Engineer, Rennie.

"At Dunmore, the pier was built, in 1815, of large rubble stone, with an average slope of 3 to 1. In 1832, the works were in so ruinous a state that the engineer reported that the sea pavement had been broken up, and the pier breached through almost its whole length, and that the breaches were widening and advancing towards the pier-head every storm."

"When examined in 1845, it was found that many large stones had been previously washed from the slope, and then formed a spit from the pier-head, 112 feet long, projecting in a slanting direction across the harbour's mouth, and dry at low water."—Engineer, Mr. Alexander Nimmo.

Sir John Rennie, in his work on Plymouth Breakwater, does not admit that these examples can be considered as proofs of any weight against the eligibility of the long slope. He attributes the failure at Donaghadee to its vertical pier-head, and adds, that a great part of the long slope "stands remarkably well." As to Portrush, he says the work was left in an unfinished state, that the rubble thrown down was not in sufficient quantity, as "the very principle of construction of works of this kind consists in supplying rubble as fast as the waves draw it down, until they have formed the slope or angle of repose at which the rubble will lie without material change of form." In regard to Dunmore, he says the work was formed with a light, soft stone, and that the failure arose from "defective workmanship, bad materials, and too steep a slope."

In this vindication of the long slope, as exemplified in existing works, no notice is taken of the failure of Ardglass Pier, with its lighthouse, though so emphatically stated in the Report to "now lie" "a mass of ruins in the sea."

The disasters which have befallen the Plymouth breakwater are attributed, both by Sir John Rennie in his account of it, and by Mr. George Rennie in his evidence, to the insufficiency of the slope that was given to it by Mr. Whidby—merely one in three, instead of one in five, as Mr. Rennie would have wished it to have been. Mr. George Rennie, in his examination, was asked, "Has it not been the case throughout the construction of the Plymouth breakwater, during thirty-four years, that scarcely a winter has passed in which some part of the breakwater has not been damaged?" *Damaged* he did not admit; his answer was, "Not damaged, but removed. I think our error was to begin to finish too soon." That finishing, however, had admitted of no delay, as appeared by the recommendation of the Commission of Engineers, 1825 (of whom were both Sir John and Mr. George Rennie); "the very principle" of supplying rubble as fast as it was thrown down had failed; they therefore recommended the construction of "a course of granite masonry, composed of large blocks well squared and dressed, and firmly imbedded horizontally, and well dovetailed, dowelled, and lewised together with strong iron bolts run in with melted lead." This course not having been found a sufficient protection, the whole, consequently, has been made as smooth as possible with large stones.

Captain Vetch said, in his evidence, that security had been afforded on the Plymouth breakwater "by the upright wall which protects the lighthouse." In reference to this, it would seem, from page 59 of the account of the Plymouth breakwater, that Mr. Stewart, in his examination, was asked, "Was any part of it ever made upright?" to which he replied, "Never."—"So that the upright building was never tried?"—"Never." This apparent discrepancy in the evidence of these gentlemen appears to have arisen from a miscomprehension of Captain Vetch's evidence. The question of the Commissioners, 846, was thus replied to by the Captain,—"The percussive force of the sea is created by the form of the

breakwater, which resists the sea but partially; the remainder falls over the crest, and expends itself on the water inside. I believe that if an upright wall was constructed at the bottom of the pitching of the outward slope of Plymouth breakwater, it would prevent, or resist, the breaking of the wave; and this is *nearly* the plan which has been adopted at the west-end, to protect the lighthouse. There an upright wall has been built, from two feet under low-water mark; and it is my opinion, as well as that of the keeper of the lighthouse, that without this protection there would be no safety."

Sir John Rennie's account of the breakwater, with the papers he has published as a sequel, seem to have been intended as a refutation of the many allegations that had appeared in its disfavour It might have been expected that Captain Vetch's assertion, that the sea rolls over the breakwater from end to end near the time of high water, would have been contradicted unless true; as also, that this mischievous effect is sometimes produced even at low water, a vessel of two hundred tons having been borne by the waves over the summit of the breakwater; and further, that all attempts to construct a breast wall upon it have failed: these facts must, therefore, be considered as established, and tell against the long slope.

The evidence in favour of the long slope, besides that already quoted, consists principally of those of Sir Howard Douglas, Sir William Symonds, and Mr. Alan Stephenson. Sir Howard Douglas, in page 47 of the account of the Plymouth breakwater, says, that perpendicular rocks exposed to the action of waves are *protected* by long slopes in front of them formed by their *debris;* "that enormous inroads" are made on bluff cliffs "until those cliffs are protected by sloping beeches formed by their fragments."

Mr. Alan Stephenson had failed in the construction of an upright wall. His opinion of the great percussive force with which waves strike, rested on experiments he had made with an apparatus exposing a foot square of surface to the sea. These experiments were made in very different situations, but all of them near the shore; and nothing appears that can indicate whether breakers had been formed or not by the passage of the waves over inclined planes before they touched the instrument.

Sir William Symonds, in his Protest, said, "The evidence on the mode of construction is conflicting and unsubstantial, the majority of theorists being in favour of the upright wall; but as they are not borne out by a single practical experiment in deep water, and in an exposed situation, where the foundation is doubtful and hazardous, I tremble for what may be the result."

"My own experience has shown me the Harbour of Valetta, in Malta, which has a width of entrance of 1,200 feet in deep water, the coast on each side of which is formed of perpendicular masses of rock, producing an abrupt resistance to the sea. I would ask any one who has seen the effect of a *gregale* (north-east wind), which makes it dangerous at times for the largest ship to enter the harbour, owing to the extraordinary agitation or commotion created by these perpendicular rocks in an on-shore gale." This example does not go to the exhibition of any *instability* of a perpendicular face; and as to the commotion occasioned by the rocks, it can hardly be supposed that a storm which removed nearly "200,000 tons of stone" on the slope of the Plymouth breakwater, carrying large blocks of it "entirely over the surface a distance of 138 feet," could have done otherwise than produce a commotion dangerous to ships at the entrance of the harbour of Plymouth Sound.

The Commissioners, in their Report recommending the upright wall, say, after giving the above-quoted statement of failures of the long slope, "In contrast to the above facts, we quote from the same official communication relative to Kilrush Pier, which fronts the Atlantic near the mouth of the Shannon."

"When examined in September last, it appeared in perfect order; nor has it cost one shilling for repairs since it was completed. Kilrush Pier presents an upright wall to the sea." (Devised by Lieut. Col. Harry Jones.)

The Report continues, "These practical illustrations, together with the weight of evidence bearing on the subject, lead us to the unhesitating recommendation of a wall nearly upright, to form the inclosure of the harbour proposed to be constructed in Dover Bay."

The expression of "nearly upright,' provided for the well-known expediency

of giving a broad foundation to walls of great depth or height, and the economy resulting from diminishing the breadth of wall as it advances in height; and from evidence, there was reason to believe that a small degree of batter might be given to a wall, without danger to it from the wave.

Throughout the Protest of Sir Howard Douglas, it appears that his main objection to an upright wall for Dover Bay was, that of such a structure in deep water there was no example. In his Protest he says, "Professor Airy admits all for which I contend; namely, that the mode of construction recommended by a majority of the Committee is *experimental*, difficult of execution, perhaps impracticable;" to which Sir Howard adds, "detrimental in its results:" but that it would be *detrimental* in Professor Airy's opinion does not appear by his evidence. Sir Howard afterwards says, in his Protest, "I avow my entire want of confidence in, and objection to, any *experimental* attempt to build breakwaters with upright faces from the bottom, in deep water, but admit that it may be deserving of consideration whether a combination of the upright face with the slope might not be made with advantage. The sectional area of the work, and consequently its mass, would be vastly less than if raised in one slope to the crest." He afterwards advises "proceeding upon nothing experimental or speculative, however high the authority, ingenious the expedient, or alluring in an economical sense the proposition."

Many other gentlemen concur in the notion that a perpendicular wall in deep water was wholly *experimental*, and, *therefore*, hesitated to recommend it. But, with deference to the opinion of such very high authority as Sir Howard Douglas, has not our high position in engineering and mechanical skill been obtained by daring to proceed experimentally on speculative proposals?—that is when, on investigation, the expedient seemed worthy of a trial.

At the time of the Commission, however, a sea wall with a vertical face, in deep water, on a bad foundation, and exposed to a heavy sea, was no longer experimental—such an one had stood unscathed at Sheerness since the years 1811 and 1812.

This wall at Sheerness was built on Sir Samuel Bentham's buoyant masses.* It is that part of the wall which is in front of the Ordnance Basin or Chamber, that part of the sea-wall on which the guns are now placed; yet, firm as it has always stood, it has all along been represented as a failure. For instance, Mr. George Rennie having been asked by the Commissioners, "Do you know any case in which an upright wall has been built in modern times in such deep water as that in which we propose to erect this breakwater?" replied, "I know the case of Sheerness, where the masses were sunk to form an upright quay wall." "In what depth of water?"—"It is something like thirty odd feet:" and the same gentleman, in his Report, said, "The destruction of the cones at Cherbourg, and the *failure of the brick masses at Sheerness*, are sufficient arguments against the adoption of caissons or other expedients."†

As to the cones at Cherbourg, the report of French engineers upon that harbour gives a widely different view of the cause of failure from that which has generally been believed. A gale, the Report says, came on before the second cone was filled with stones, whereby it was carried away down to low-water mark. The Report continues, "This event was the cause of, or the *pretext* for, great changes in the disposition which had first been adopted." It was then determined that the cones should be at greater intervals, and the intermediate spaces filled with large blocks of stones. Those intervals were subsequently increased to 390 metres; "but after sinking eighteen of these cones at different intervals, thus *isolated and imperfectly filled up*, they soon experienced repeated damage, and this system of construction was accordingly soon abandoned." They were "cut down to low-water mark in the year 1789," and *pierres perdues* had recourse to. The French engineers further state, in their Report, that a bad form for the breakwater was employed, as the military engineers insisted on a plan of defence, with which the breakwater, if properly placed, would have interfered. The failure of the cones

* *Mechanics' Magazine*, Nos. 1300, 1310.
† Account of the Plymouth Breakwater, p. 55.

appears from this Report to have arisen from their having been left in an unfinished state, and from their being isolated; yet the Report implies that they were not abandoned from any real imperfection of the plan, but because the injury they had suffered was made a pretext for a change of plan: it must be remarked, too, that they were only cut down to low water, and that the parts of them below low water still remain; so that the cones at Cherbourg cannot be considered as "against the adoption of caissons or other expedients."

Sir Samuel Bentham's wall at Sheerness was constructed under unexampled disadvantages. In consideration of the badness of the ground at Sheerness, the magnitude of the works in contemplation there, and the unusual expedients it would be desirable to adopt so as to carry on these works with economy, he requested to be allowed the assistance of a resident engineer. The Navy Board seeing the reasonableness of this request communicated it to the Admiralty, observing, that they "considered it as of great importance that Commissioner Bentham should be allowed such assistance as he has occasion for in carrying the work into execution." The Admiralty refused.* On a subsequent occasion he requested to be allowed to engage four bricklayers, at a rate of pay of 6*d.* a day beyond the nominal pay of the yard; but this on condition that their meals and hours of work were to be regulated according to the tides, and the day's work to consist of ten working hours; thus doing away the costly extras habitual in all royal dockyards—these men were, moreover, not to object to working with convicts. This sixpence a day was refused, and the superior men in view were lost. No carpenter, excepting one as a leading man, could be spared from the dockyard—the wooden bottoms of the masses were therefore built by a gang of twelve convicts; for whose services Sir Samuel advanced a gratuity of a guinea a week amongst the whole number according to their assiduity and good workmanship, and this there was some difficulty in being allowed; many of the bricklayers were also convicts. Constructed under such circumstances, had buoyant masses failed, had the upright wall been washed away, the wall at Sheerness could not have been evidence of any imperfection of the plan, either as to buoyant masses, or to the vertical face of the wall.

Yet there still stands the wall. It is at that part of the arsenal most exposed to heavy seas; and it is doubtful whether, in storms, works at Sheerness may not be liable to as much injury as at any other port whatever; the sea breaks there in short waves with great violence.

This vertical wall has been subjected to trials of unusual severity. The last of the foundation masses was sunk in the summer of 1812. Sir Samuel purposed the construction to landward of them of store cellars, and other accommodations that would have afforded additional strength to the wall; but a design having been determined on different from that he had proposed for Sheerness, his wall remained from 1812 to 1825 in its imperfect state. Thirteen years exposed, not only to the force of the waves to seaward, but also to violence from the influx of the sea behind it. Had this wall been intended merely as an experiment to try whether a wall, vertical on both sides, could or could not resist the fury of waves in a storm—under no more trying circumstances could such an experimental structure have been placed.

After the Bentham wall had thus stood for so many years, it having been reported, notwithstanding, a failure, in 1824-5, when the new part of the yard was completed, it was determined to take that wall away, and to make a new wall for the whole frontage, and a contract for this work was accordingly entered into; but on proceeding to the work the masses were found to be *quite secure*, and that it would therefore be better to merely bring up a new facing to correspond with the line of the other wall.

This new "facing" occasioned ill-usage to the mass wall, such as might have materially injured its stability if weak. In adding the new face, the original work was cut into in order to afford bond and support for the new stones. Where the new work projected at bottom beyond the original masses, there indeed piles were driven; but the great mass of the new work rested upon, still rests upon, and is supported by the original masses.

* See *Mechanics' Magazine*, No. 1310, note, p. 280.

The many allusions to this work in the examination of the Commission on Dover Harbour have rendered it an example of considerable notoriety, and of general importance in the question of the upright against the long slope, as most desirable for a sea wall. Preceding papers in the *Mechanics' Magazine* afford testimony of the stability of the upright wall at Sheerness.

The Commission in their question, No. 371, put to Mr. John Rendel, said "Mr. George Rennie, in his Report, says, 'the failure of the block masses at Sheerness are sufficient argument against the adoption of such an expedient;' are you aware what failure he alludes to?" Mr. Rendel, "Not at all, I am perfectly at a loss to know; if it is what I understand, it is a most extraordinary instance, because, if I remember rightly, the accident at Sheerness was owing to this, they had not driven sheet piles in the face of one of their basin walls, the ponding of the water blew out the foundation, and perfectly undermined the wall; and what was an important part of the thing was, that those very brick walls stood while the workmen went under them and underpinned them."

From this reply, in addition to Mr. Rennie's statement, it could not but be concluded that the mischief happened to a part of the mass wall of Sir Samuel Bentham. It was not so; no water ever got under General Bentham's masses; they stand about 300 yards to the north of the failure alluded to in Mr. Rendel's evidence. That failure happened early in March, 1820, not owing to the want of sheeting piles, but to an extraordinary high tide, and strong gale from the north-west, which drove one of the convict hulks against the coffer dam, disturbing the piles. The work being in an unfinished state, the water made its way under the wall, following a longitudinal direction, leaving a chasm about 6 or 7 feet deep, with the whole of the work standing on the top of the piles. After clearing a sufficiency of mud, silt, and quicksand from under the invert of entrance, and the wall on each side, the whole was under-pinned and made good with brick work.

Mr. George Rennie, in his evidence, subsequently admits that upright walls in the Mediterranean have stood for no less a time than 1,800 years.

In Sir John Rennie's work, page 36, he says, "If we examine the effects of waves against upright walls, or artificial works, as at Port Patrick, Donaghadee Pier-head, Whitehaven, Berwick, Scarborough, Whitby, Ramsgate, the inner walls of Kingstown, Boulogne batteries, Boulogne and Calais pier-heads, Havre, Cherbourgh, and many other examples, we find that the shock is greater, and the consequence more serious, than when striking against an inclined wall." In these instances no particular failure or damage being specified, the inferiority of upright walls is no otherwise indicated than as his own opinion. In one instance, Sir John gives specific information as to the injury done to an upright wall; he says, "In the memorable gale, or rather hurricane of Jan. 6, 1839, the waves made a clean breach of the interior upright wall of the pier-head of Port Patrick Harbour, which was of solid masonry, 13 feet 6 inches thick, founded 24 feet below low water on the solid bottom, bonded, dovetailed, and dowelled together by means of chain bars, tree-nails and stone dowels, and every possible precaution to ensure stability in masonry; this work has been subsequently restored by a solid wall nearly three times the original dimensions." "It is worthy of remark, however, that while the vertical wall received so much damage, the flat rough rubble slope at the back of the pier-head, which was similarly exposed, received comparatively little injury, which was repaired at one-fifteenth part of the cost and time."

This is the only specific case that appears of any failure of a vertical wall. What the total height was of that pier-head is not mentioned, but as it was constructed in 24 ft. water, it may be doubted whether 13 feet 6 inches was a thickness of wall sufficient to afford stability in the event of hurricanes;—probably the failure arose from an insufficiency of base, not from the vertical form of the wall.

It would render an essential service to engineers, who in future may have to devise sea walls, were persons conversant with the works above specified by Sir John to communicate to the public in what respect those which have upright walls have failed, and whether such failure has arisen from their being vertical, or from insufficiency of mass, or of details of construction.

The scientific opinions obtained having been generally in favour of the vertical wall, it seems needless to lengthen this already long communication by detailing others than those of Professor Airy and Captain Vetch. Professor Airy was asked, "Do you not think that waves in heavy gales, coming in with considerable velocity, and in that state, would act upon an upright wall with the percussive force due to their weight and velocity, and produce a more serious effect than if that impact were to act against a slope?"—Answer, "It will not strike at all. There will be a great swell up and down again; there will be nothing like a horizontal motion." Question—"The wave is proceeding?"—"It becomes a stationary wave; a combination of a direct and a reflected wave. It goes up and down again without breaking; and it is merely an elevation of the surface. I have been in circumstances where I have had good opportunities of observing that practically, and I know that that is the case." Q. "You say that inasmuch as a wave does not break against an upright surface, it will exert no percussive force upon the wall?"—"No. It will exert the same sort of pressure that there is upon a lock-gate, that is, a hydrostatic pressure." Q. "Equal to the weight of a column of water whose base is the surface pressed, and height the depth of the centre of gravity?"—"Yes."

Captain Vetch had stated that waves rise and fall against a perpendicular wall, and recoil from it; he was again asked if that was his opinion? He answered—"That is my opinion. I had a very extraordinary instance of that happen in my own case. In going out of the little harbour of Scarnish, in the island of Tyree, in a vessel of 25 tons, we were carried three times up and down a rock inclined to the horizon at an angle of about 60 degrees, with the wind on shore, and without touching it, though the gunwale was within a yard of it." "It was blowing fresh."

A combination of the long slope with the upright wall was also considered by the Commissioners. In favour of this form of construction there was much evidence, both practical and scientific,—showing that, to use the words of Major General Paisley, "The action of waves is superficial." In his examination, he said, "It has always been my opinion, and this has recently been confirmed by the observations of the divers employed under my direction in removing the wreck of the *Royal George* at Spithead,—that the action of the waves is superficial, and does not extend much below or above what the natural surface of the water should be in a calm. Hence, when the divers had their breast lines and air pipes let out so far as not to be jerked by the pitching or rolling of the lighter from which they descended, they could work as efficiently in the heaviest sea as in a calm, and they were often most successful in strong gales of wind; but they could not struggle against strong spring tides, for the tides acted as powerfully at the bottom of Spithead as at the top, which I believe must be the case everywhere; and they observed that it changed at the bottom a little earlier than at the top." "The tides, however, are not capable of carrying away large blocks of stone." "The water at Spithead is nearly double seven fathoms."

Facts thus obtained on such a subject, and related by so accurate an observer, cannot fail to be of great practical use in the construction of under-water works.

Captain Washington, in speaking of the terrific action of the waves upon the long slope at Cherbourg, said that in that instance their mischievous action did not appear to extend lower than from fifteen to twenty feet below low water, as the small stones there remain unmoved.

Sir John Rennie, in the account of the Plymouth breakwater, says, that "No part of the work below low water was disturbed by the gale."

Sir Howard Douglas, in his paper, 1st July, 1844, said, "I avow my entire want of confidence in, and objection to, any experimental attempt to build breakwaters with upright faces from the bottom in deep water, but admit that it may be deserving of consideration whether a combination of the upright face with the slope might not be made with advantage. The sectional area of the work, and consequently its mass, would be vastly less than if raised in one slope to the crest."

Mr. Rendel, in his examination, said, "But it should be remembered that we have recourse to sloping breakwaters in order to make cheap materials stand in the place of expensive labour." In conformity with this mean of effecting economy, he said, "I should first of all

begin to deposit those materials to form a rough mass up to within a moderate depth at low water, and then when I had brought my foundations up to that point at which the sea would begin to attack me, I should begin to attack the sea by building with a class of materials that would be its master. I think an upright wall in that case would be desirable."

Thus it seems that in that part of a breakwater where the sea exerts the greatest force, even Sir Howard Douglas admits it to be worthy of consideration whether the upright face might not be advantageous; and Mr. Rendel decidedly relies upon the vertical wall instead of the long slope for parts the most exposed.

Amongst the plans proposed to the Commissioners, was one by Mr. Cubitt for the construction of caissons of wood, to be built in with masonry, sinking these masses of wood and stonework so as to leave an interval between them of 20 or 30 feet; "and that," as Mr. Cubitt said, "would make this harbour, with this great advantage, that there would be always what is called live water inside."

For the formation of Dover Harbour, the Commissioners had two great difficulties to contend with, the great quantity of mud and silt floating in its waters, and the immense mass of shingle that travels at times along that part of the coast. The preservation of live water would have been in a great degree effectual against the deposition of mud and silt, as Mr. Cubitt proposed, but the still greater evil of a permanent accumulation of shingle between and within his caisson masses was to be apprehended, should such a plan have been adopted.

Captain Washington had been directed to make experiments which should ascertain the quantity of silt in Dover Bay. It appeared from the whole of these experiments that the silt would amount to 1,200 tons an acre. Lieutenant-Colonel Colquhoun said that, "In the docks at Liverpool, the quantity of silt dredged is stated to amount to upwards of 10,000 tons per acre per annum." The Commissioners to learn the cost of dredging, inquired of Mr. George Rennie the price at which that operation could be performed; he stated it at 3d. or 4d. the cubic yard for dredging alone, from a depth of 30 feet; but including removal, 9d. a yard. This rate of expense far exceeds that which it cost Government to dredge, which in one case (*Mechanics' Magazine*, No. 1150,) amounted to less than a penny per ton; in the other, where shingle was raised from a depth of 27 feet, to less than 2d. per ton; in both these instances wear and tear of the machinery was included, and interest on the capital sunk for its procurement; but there were no contractor's profits, which were probably allowed for in Mr. Rennie's prices. Although the deposit in Dover Bay be so much less than in the docks at Liverpool, yet, considering their small extent compared to that of Dover Bay, the expediency of dredging there was seen to be doubtful, and the idea of dredging the new harbour appeared to be generally abandoned on account of expense. One expedient was, however, suggested which might diminish that expense, that of employing the engines of steam-tugs, at their spare time, in dredging to keep the harbour clear.

That the danger of filling up with silt was not imaginary Mr. Rennie proves, by his statement, that "the harbours of Valencia and Barcelona, and many other harbours in the Mediterranean with solid piers," have been injured by sand accumulating against them; and that the harbour of Civita Vecchia, formed by a long slope, is now filled up with alluvium that came down the river.

Another plan for preventing such injury to Dover Harbour was suggested by Lieutenant-Colonel Colquhoun,—that of building the western pier on arches, thus allowing the tide to carry silt through; on the supposition, doubtless, that the eastern pier would arrest the shingle.

The shingle, however, appears to be the most formidable enemy to be guarded against, and much important evidence was obtained under this head. It appears that gales of wind carry shingle along the coast, but that it is not moved by the tides. That in Dover Bay shingle does not extend outwards so far as low-water mark. That there is always a line of sand at low-water mark. That shingle does not go farther northward than Shingle-end. That there is said to be no shingle on the French coast between Cape Grisnez and the Texel; on that coast it is sand.

With a view of arresting the enormous quantity of shingle that now travels along the coast, and enters Dover Bay, different forms, positions, and numbers of breakwater piers were proposed by many eminent engineers, civil and military, each plan being supported by facts and arguments brought forward severally by these gentlemen; but as they related more particularly to the local circumstances of the Bay, it does not seem of an interest sufficiently general to enter into particulars here.

Floating breakwaters were spoken of by some gentlemen; but it is evident that where the inroads of such a mass of shingle has to be guarded against, and where there is no backwater to carry it away, a floating breakwater would not be effectual.

Many plans for the construction of fixed breakwaters were proposed besides the above-mentioned, and others with the long slope. Captain Vetch proposed iron caissons to be filled in. Mr. Walker's plan was to build walls at the island of Portland in navigable vessels of 300 or 400 feet long, and 70 wide, and then to tow them to Dover. Captain Denison proposed a vertical wall, composed of hexagonal prisms, to be manufactured at Dungeness; these prisms, when sufficiently hardened, to be towed to Dover between two cylindrical pontoons; but above low water-mark to substitute granite.

The sufficiency of various materials in sea walls was examined into. In respect to concrete, it was generally objected to for external work: its specific gravity is about the same as that of brickwork. This material has been tried at Algiers, but is said to have failed from the decomposition of the lime by the sulphate of magnesia contained in sea water. The water in the Mediterranean is stated to contain 7·02 per cent. of this sulphate, but the water of the ocean only 2·29 per cent. But for *foundations*, it is added, in respect to concrete, "its value is unquestionable."

Bricks, as materials for exposed works, were objected to by some as being liable to abrasion, by others from apprehension of their being crushed under great weights. Mr. Rendel, in proof of the fallacy of the latter objection, instanced "Mr. Tenant's chimney at Glasgow, which is 360 feet high, and has never shown the slightest symptom of crushing at the lower courses of bricks, although nothing more than common brick work."

DAVIES'S ROTARY ENGINE.

Sir,—I shall feel obliged if you will publish the following, in answer to Mr. W. H. Gordon's communication in No. 1372 of your Magazine. Mr. Gordon states, that he is not aware whether or not I saw his work on the "Economy of the Marine Steam-engine" previous to taking out the patent for the duplex-piston rotary engine. Now, Sir, I wish it to be distinctly understood that I never saw or heard of any such work as Mr. Gordon alludes to, until I saw his letter in the Magazine. I will now take the opportunity of offering a few words, explanatory of my practice in perfecting the rotary engine. I have had forty-two years' practical experience with the reciprocating engine, and during the last twenty-five have been mixed up with the superintendence of a number of attempts which have been made by different parties to produce a rotary engine. It was but natural, therefore, that my attention should be attracted to the subject. My first idea was to make a double revolving piston; but after trying a number of experiments for giving the proper action to the valves, which did not answer, that idea was abandoned. I then began the single piston engine, and so far succeeded, as to more than realise all my expectations; and it was after I had got this engine to work, and patented it, that I again turned my attention to the duplex piston engine—not to perfect the piston, but to produce a motion that would give the proper action to the valves. And if I had not made the motion for the single piston engine first, it is a question with me, whether I should have perfected the duplex motion at all. I may here remark, that I have heard it stated by high authority, that no man would be able to produce a rotary engine that would work without a great amount of undue side-pressure on the shaft. And this imaginary impossibility I was determined, if possible, to overcome.

I am, Sir, yours, &c.,

ISAIAH DAVIES.

44, Bromsgrove-street, Birmingham,
December 3, 1849.

EXPERIMENTS ON THE DISCHARGE OF WATER FROM PIPES, MADE UNDER THE SANCTION OF THE METROPOLITAN COMMISSIONERS OF SEWERS.

Sir,—I send, for the guidance or consideration of those of your readers whom it may concern, some account of experiments made on the discharge of water from pipes, with a view to ascertain the requisite sizes of various aqueducts for the purposes of drainage. It was necessary to conduct these experiments, as to arrangements of apparatus, in a different manner than if it had been required to know the necessary sizes of pipes for supplying a town with water, as, in the former case, there being no pressure arising from head, a flow of water of uniform section is maintained by the continual addition of lateral streams: and the length of the aqueduct, therefore, as an element of friction, may have little or no influence on the velocity of the main current; while in the case of waterworks, the velocity of the water depending on the head at the origin of the system, length of pipe is a most important element in calculation; and the friction arising from this condition is often the chief force to be overcome. In fact, under these two circumstances, reverse effects are produced: for in a drain, if the length be increased, and junctions be proportionally added, a greater amount of discharge will be the result (I always assume that the junctions are made in the most scientific manner with regard to their aiding the main line); and in another respect the operations of a system of drainage and a system of waterworks are curiously dissimilar; for in the former, the chief current being supplied immediately by its tributary mains, sustained by their various ramifications, and ultimately fed by a multitude of small mouths, the whole operation proceeds naturally and easily by the silent effort of gravitation; while in the latter case, the main line being first charged, the water has to be forced with sufficient power to divide itself, and move with great velocity in a multitude of different directions, up hill and down hill, through intricate and narrow passages turning at every variety of angle. In the latter work, again, the power is generated at once at the head of the system, and is continually being expended so long as it acts; but in the former, force is self-generating —it accumulates as the operation enlarges, until the small tributaries become important streams, and these streams an impetuous torrent. It is easy to perceive at once what an important part *friction* plays in the one case to what it does in the other. Hence, with regard to *formulæ* constructed on the basis of experiments made with heads of water at the ends of pipes, they have proved totally useless as means of ascertaining the proper sizes of drains and sewers; and when tested by the actual discharge of a drain, I have found them so much in error that I could have guessed by the eye much nearer the truth. The *formulæ* of Prony, Dubuat, Eytelwein, Geniey's, Young, Smeaton, and others, not only each of them departs very wide of the truth when applied for the purposes of drainage, but they all disagree the one with the other, so much as to destroy confidence in any one of them, unless confirmed by other evidence. The experiments which I am about to describe were made under the sanction of the Metropolitan Commissioners of Sewers, on their premises at Greek-street. The apparatus used was as follows:—A strong platform, 100 feet long, was erected, fixed to move about a central axis at one end, and free to be moved at the other by a chain and windlass, so as to afford a range from the horizontal plane to a declivity of 1 in 10. A tank, holding 1600 gallons, was placed at the upper end; and another tank of sufficient dimensions, received and measured the water discharged at the lower end. On this platform lines of pipes, varying from 3 inches to 12 inches diameter, were tried. The pipes consisted of the ordinary Vauxhall stoneware, in two-feet lengths; and a careful selection of them was made as to accuracy of bore and dimensions. They were laid in straight lines of uniform inclination, and the pipe joints were rendered water-tight with clay. On each side of a line of pipes, five junctions were attached at intervals, by which the water was admitted, as well as at the head of the pipe. The entrance of the water was regulated by sluices; so that while the head of the pipe was just filled, water was at the same time admitted by the junctions sufficient to maintain the pipe full throughout its entire length. Under these cir-

cumstances, we found—to mention only one result—that a line of 6-inch pipes, 100 feet long, at an inclination of 1 in 60, discharged 75 cubic feet per minute. The same experiment, repeated with the line of pipes reduced to 50 feet in length, gave very nearly the same result. Without the addition of junctions, the transverse sectional area of the stream of water near the discharging end was reduced to one-fifth of the corresponding area of the pipe, and it required a simple head of water of about 22 inches to give the same result as that accruing under the circumstances of the junctions. With regard to varying sizes and inclinations, we found, sufficiently for practical purposes, that the squares of the discharges are as the fifth powers of the diameters; and again, that in steeper declivities than 1 in 70, the discharges are as the square roots of the inclinations; but at less declivities than 1 in 70, the ratios of the discharges diminish very rapidly, and are governed by no constant law. At a certain small declivity, the relative discharge is as the fifth root of the inclination; at a still smaller declivity, it is found as the seventh root of the inclination; and so on as it approaches the horizontal plane. This may be exemplified by the following results found by actual experiment:—

Discharges of a 6-inch Pipe at Several Inclinations.

Inclination.	Discharges in 100 ft. per minute.
1 in 60	75
1 in 80	68
1 in 100	63
1 in 120	59
1 in 160	54
1 in 200	52
1 in 240	50
1 in 320	49
1 in 400	48·5
1 in 480	48
1 in 640	47·5
1 in 800	47·2
1 in 1200	46·7
Level	46

The series of hydraulic experiments from which the foregoing is selected, has been in operation for the last two years, at an expense of upwards of 2000*l.* The experiments conducted at Greek-street were a continuation of similar experiments made in the Fleet sewer; in the latter place the sewage was used, and in the former pure water supplied by the New River Company.

The conclusion arrived at is, that the requisite sizes of drains and sewers can be determined (near enough for practical purposes, as an important circumstance has to be considered in providing for the deposition of solid matter, which disadvantageously alters the *form* of the aqueduct, and contracts the water-way) by taking the result of the 6-inch pipe under the circumstances before mentioned as a *datum*, and assuming that the squares of the discharges are as the fifth powers of the diameters.

That at greater declivities than 1 in 70 the discharges are as the square roots of the inclinations.

That at less declivities than 1 in 70 the usual law will not obtain; but near approximations to the truth may be obtained by observing the relative discharges of a pipe laid at various small inclinations.

That increasing the number of junctions at intervals accelerates the velocity of the main stream in a ratio which increases as the square root of the inclination, and which is greater than the ratio of resistance due to a proportionable increase in the length of the aqueduct. The velocities at which the lateral streams enter the main line, is a most important circumstance governing the flow of water. In practice, these velocities are constantly variable, considered individually, and always different considered collectively, so that their united effect it is difficult to estimate. Again; the same sewer at different periods may be quite filled, but discharge in a given time very different quantities of water. It should be mentioned that in the case of the 6-inch pipe, which discharged 75 cubic feet per minute, the lateral streams had a velocity of a few feet per second, and the junctions were placed at an angle of about 35° with the main line. It is needless to say that all junctions should be made as nearly parallel with the main line as possible, otherwise the forces of the lateral currents may impede, rather than maintain or accelerate the main streams.

The conclusion of the labours of the learned authors of the several formulæ before quoted, left the science of hydraulics in such a state, that no man, except by his own practical observation, could tell what an aqueduct, under any given

conditions, would discharge. This will be so apparent to any one who will take the trouble to examine and compare the various formulæ the one with the other, and to test their general pretensions by some known facts, that I need dwell on it no longer. It would be a valuable thing if practical men would make a common record of facts occurring in their own experience,—*facts, not conclusions derived.* No doubt the facts exist in sufficient abundance; but they are too scattered, or appropriated as secrets, so that the engineer is often obliged to assume results which he has not had an opportunity of verifying by practical experience. Had such a record been current, the formulæ of the hydraulicians could not have been received as orthodoxy by the scientific world.

I am, Sir, yours, &c.,
J. L. HALE.
Civil Engineer.

1, Greek-street, Soho,
Dec. 4, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 6TH OF DECEMBER, 1849.

EDMUND GRUNDY, Bury, Lancashire, woollen-manufacturer, and JACOB FARROW, of the same place, manager. *For certain improvements in machinery, or apparatus for preparing wool for spinning, and also improvements in machinery or apparatus for spinning wool and other fibrous substances.* Patent dated May 29, 1849.

The patentees describe and claim,

1. An arrangement of apparatus for forming the roll or lap of the wool, previously to feeding it into the trimmer or scribbler, into a continuous sheet of uniform weight and thickness throughout; and particularly the employment of canvas for that purpose.

2. A mode of unlapping the roll from the trimmer and winding it on to a cylinder of large diameter, after which it is severed into sheets of uniform weight and thickness.

3. A construction of apparatus for piecing or connecting these sheets.

4. A peculiar arrangement and construction of mechanism, for drawing the sheets so pieced, or connected, into continuous slivers.

5. The application of a fixed rail in place of the roller, which is usually placed between the roller and dish.

6. A mode of regulating the motion of the copping rail, so that one end may descend quicker than the other to form the bottom of the cop, when both ends will descend equally.

7. An arrangement for stopping the revolution of the spindles by throwing the rimband from the twist roller on to the loose roller and effecting the backing off.

8. A mode of regulating the winding up of the yarn by means of a scroll on the tin roller, which is actuated by a notch wheel, or other suitable mechanism.

9. Taking the strain off the yarn by lowering the faller during the running in of the carriage.

10. Increasing the speed of the spindles during the running out of the carriage, by throwing the twist band on to the loose pulley.

DAVID SMITH, New York, America, lead manufacturer. *For certain new and useful improvements in the means of manufacturing certain articles in lead.* Patent dated May 29, 1849.

The patentee proposes to employ a tower of 20 inches in diameter, and 50 feet high, shaped at top like a funnel, and at bottom like a truncated cone. The pouring vessel is to be made with holes in the bottom as usual, and fixed in the funnel, while an annular hollow vessel is adapted to the bottom of the truncated cone, and rests on a reservoir of water. The annular poring vessel is to be also perforated with holes at top, through which an artificial current of air is to be forced up the tower by a fan or other blowing machine. Supposing the current of air be made to travel twice as fast as the falling molten metal, the latter will encounter as much air as it would in falling through a tower 150 feet high, of the ordinary construction, and probably more, as the air would be nearly stagnant. The metal falls through the hollow centre of the annular vessel into the water reservoir, which is furnished with a shoot to conduct the metal to a suitable receptacle. Or, the artificial current may be created by exhausting from the top of the tower, and allowing the air to flow in at bottom; in which case the hollow annular vessel will be dispensed with.

Claim.—The application of an ascending artificial current of air to a descending current of metal in the manufacture of leaden shot.

JOHN DUGDALE and EDWARD BIRCH, Manchester, tool and machine makers. *For certain improvements in constructing and propelling ships or other vessels.* Patent dated May 31, 1849.

The patentees describe and claim,

1. A method of constructing ships and vessels with horizontal channels, open to the water at bottom, in which the propelling shafts are to be placed.

2. The employment of two or more propellers, of different diameters, keyed upon the same shaft.

RICHARD EDWARD HODGES, Bycroft, Hereford, gentleman. *For improvements in mechanical purchases, which are also applicable in whole or in part to projectiles.* Patent dated May 29, 1849.

Claims.—1. The employment for pulling and hauling purposes, and all others where a resilient force can be usefully applied, of purchases made of vulcanised caoutchouc or other like elastic substance, either solid or tubular, and either round or flat, or of any other shape, and fitted with loops or hoops for attaching the same singly and successively to the bodies which are thereby to act or to be acted upon.

2. The application of elastic purchases, of the description aforesaid, to projectile purposes.

3. Certain improvements in travellers' staffs.

4. A double wheel-barrow, as described.

Full particulars of this invention will be given in our next.

HENRY TREWHITT, Sunbury, Middlesex, and THOMAS RUSSELL CRAMPTON, Buckingham - street, Westminster, C.E. *For improvements in locomotive, marine, and stationary engines; and also in the connecting apparatus of marine engines.* Patent dated June 2, 1849.

Messrs. Trewhitt and Crampton's improvements in locomotive steam engines are as follows:—

1. The axle of the driving wheels is placed behind the fire box, which, as well as the water tank, is supported on the same frame with the tubular boiler. The water tank is placed underneath the boiler, while, to make room for it, the eccentrics, air-pumps, &c., are placed outside the frame.

2. The boiler is supported, or caused to articulate on three points; one being the centre of a transverse spring, the ends of which bear upon the axle boxes of the driving-wheels, and the other two the centres of two longitudinal springs, placed on either side of the boiler, the two ends of each of which rest upon the axle boxes of the running wheels on their respective sides.

3. The top of the outside shell of the fire box is made flat and stayed to the top of the fire box, also made flat, in the same way as are the sides in ordinary cases; care being taken to leave sufficient steam space between the two.

4. The axle of the driving wheels is placed under the fore-end of the tubular boiler, and connected to cranks fixed on the ends of a transversal rod, which are driven by coupling rods from the piston rods of the steam cylinders.

5. The application of the preceding arrangement to a locomotive engine which has the axle of the driving wheels placed behind the fire-box.

6. Tapping a male screw near the crank-end of the paddle or screw-shaft in marine engines, and fitting thereon a collar with an interior screw. The crank is slipped over the extreme and smooth part of the shaft, which is prevented from slipping out by means of a collar fitted thereto. A washer is placed between the two opposite surfaces of the crank-end and screw collar, which are brought close together and kept in position by a pin passing through the shaft. The forward movement of the crank will press these two surfaces closer together, and produce the revolution of the shaft; while, if the pin is knocked out the movement of the crank reverses, and the collar screwed back one-sixteenth of an inch, the contrary effect will take place.

7. The application of the last-mentioned arrangement to stationary engines.

8. The employment of counter-balance weights in marine engines, which are made to revolve in the same horizontal plane as the cranks.

Claims.—1. Placing the axle of driving wheels behind the fire-box, in combination with the water tank and coke box on the same frame with the boiler.

2. The use of the tubular boiler with the axle of the driving wheels placed under the fore-end of it, and which is made to work or revolve as before described.

3. Arranging the connecting and disconnecting apparatus of steam engines, so that when two surfaces or discs are employed, the forward motion of the crank shall have the effect of uniting them more firmly.

4. The mode of counterbalancing unequal motion in marine steam engines.

MOSES POOLE, London, gentleman. *For improvements in "brazing, pressing," separating, cleaning, and "bleaching; and in cooling or" heating matters; "also in pistons, valves, taps, and spring apparatus."* (Communication.) Patent dated June 2, 1849.

The patentee has disclaimed those portions of his title which are inclosed within inverted commas, so that his patent is now limited to "improvements in separating, cleaning, and heating matters."

His improvements in "separating matters" consist,

1. In employing, for separating liquid from solid matters, a centrifugal apparatus, composed of a drum, lined with some suitable reticulated fabric, and fitted with a flexible tube, one end of which passes through the periphery, while the other is attached to a string which passes over a pulley to a moveable collar placed outside on

the rotary shaft. When the drum is partly filled, and rotary motion communicated to it, a portion of the liquid is expelled, and the rest retained by the interposition of solid matters between it and the drum. In that case the collar is slipped down, whereby the end of the tube is brought beneath the level of the liquid, which consequently runs out.

2. When substances of different sizes or specific gravities have to be separated, the patentee places them in a hemisphere composed of some reticulated fabric, to which rotary motion is communicated. If grain, for instance, be the article, the dirt or lighter particles will be driven through the sides, while the grain will be thrown out over the edge into suitable receptacles. When it is desired to wash the substances under operation, water is poured into the centre of the hemisphere, and the cleansing process facilitated by the application of a revolving brush to the inside surface of the fabric; or, the air may be exhausted from the outside of the hemisphere, by any suitable and well-known arrangement.

3. When soap-lather has accumulated to excess in a centrifugal scouring-machine, it is to be got rid of by laying a hollow ring, one half of which is composed of wire gauze, and connected to an air-pump, on the surface of the water; the pump being put into action, the air is thereby exhausted from the soap-bubbles, which consequently disappear.

4. To heat liquids, the patentee proposes to convey them to a rotary drum, perforated on the sides, from which they are to be expelled in finely-divided streams, and in this state brought in contact with currents of hot air or steam, which are driven through the bottom of the chamber or room, in which the apparatus is placed, by a fan or other blowing machine.

5. A slight modification of the preceding arrangements is described, which is stated to be particularly adapted to the waste-pipe of steam engines, for the purpose of applying the heat of the waste steam to the feed water, and of condensing the steam itself.

6. Another similar arrangement is described, which consists of a number of concentric channels, through the alternate ones of which heated air is made to pass, and impart its heat to the thin metal sides, which communicate it to the water flowing through the other channels.

Claim.—1. The construction of a centrifugal apparatus with a pipe, as described.

2. The mode of constructing an apparatus for separating and cleaning materials, and also the one for withdrawing air from soap-bubbles.

3. The mode of heating liquids, whereby the liquids being thrown out by centrifugal force, are brought into contact with currents of hot air, and hereby heated. Also, the application of waste steam to the same purpose.

4. The arrangement for heating air in connection with the fluid heating apparatus.

WILLIAM GOOSE, Birmingham, manufacturer. *For certain improved machinery for manufacturing nails.* Patent dated June 5, 1849.

The object of the present invention is to grip the partially formed nail on the edges instead of the ends, as has hitherto been usual; and this is proposed to be effected by adapting to the ordinary nail-cutting machine an apparatus which consists of a revolving vertical spindle with an arm curved upwards, which carries at the free or top end a bent horizontal bar of steel, termed in the specification a "spring nipper." When the partially formed nail is separated from the iron plate, one of its ends is caught by the extremity of the spring nipper at a point beneath the horizontal right line, in continuation of the end of the fixed die, and pressed against this latter, whereby the partially formed nail will be caused to make a portion of a revolution, and to assume a vertical position instead of the usual horizontal one, when the moveable die is to be brought into action.

Claim.—The employment and construction of a spring nipper in addition to nail-making machines, for causing the partially formed nail to make part of a revolution.

DANIEL MILLER, Glasgow, C.E. *For improvements in the mode of drawing ships up an inclined plane out of water.* Patent dated June 5, 1849.

Mr. Miller's improvements have reference to the well-known patent slip of Morton, and consist in combining with it a hydrostatic cylinder with a moveable ram or piston and injecting pumps, which force water into one end of the cylinder, to drive the moveable ram or piston forwards, and thereby produce a motive force, which is communicated by a traction-rod to a carriage, running on the slip, and supporting the ship, which is consequently drawn up out of the water. The moveable ram or piston is drawn back into its first position, either by winding a rope or chain on a roller, or by pumping water into the opposite end of the cylinder, or by exhausting the water previously pumped in, to allow the unbalanced pressure of the atmosphere to act, or by the descent of a weight which has been wound up during the forward motion of the moveable ram or piston.

SAMUEL DUNN, Doncaster, gentleman. *For improvements in constructing tunnels,*

and in apparatus to be used for such or similar purposes. Patent dated June 5, 1849.

Mr. Dunn's tunnelling arrangements will put the reader immediately in mind of those used by Sir M. I. Brunel, in the construction of the Thames Tunnel, and can at best be only considered as an improvement upon them. He employs a moveable shield, like Brunel, and forces it forward through the mud or sand, shift after shift, by hydraulic pressure. The fore part of the shield is constructed of iron, in the form of a plough, the point being of steel, and divided into compartments, which are filled with air compressed to such a degree as to balance the exterior pressure. The after part is elliptical in shape, and separated from the plough by an air and water-tight partition, fitted with a tube communicating with an air-pump. Between the partition and the after part of the shield is an elliptical piston, surrounded with a suitable packing, so as to fit tightly therein. A trench is dug by the water-side deep enough to receive the shield, and allow of its being placed on a level with the course of the intended tunnel, which is built inside the after part of the shield, behind the piston, and consists of two layers of planking, bound together on the outside by iron hoops, and covered with gutta percha or other waterproof material, and stayed on the inside by plates of iron riveted and cemented together, so as to form a waterproof lining as it were. When this is completed, water is pumped into the space between the partition and the piston, which is driven back until it rests against the edge of the tunnel, and becomes immovable. Whence it follows, water being continued to be forced in, that the plough will be driven forward a distance nearly equal to the portion of the tunnel built; upheaving and turning aside the mud and sand in its progress. The space between the outside of the tunnel and the inside of the shield is made water-tight by lining the latter with leather, which is kept well greased to facilitate its sliding.

Claim.—The mode of constructing tunnels by means of a moveable protecting shield, which is driven forwards by hydraulic pressure, or any other suitable mechanical means.

Victor Hippolyte Laurent, France, engineer. *For improvements in looms for weaving.* Patent dated June 5, 1849.

The patentee describes and claims,

1. An arrangement of apparatus for regulating the giving off of the warp from the warp-beam, so as to obtain a more regular and uniform cloth than hitherto.

2. An arrangement of apparatus for regulating the winding-up of the cloth upon the beam.

George Hinton Bovill, Abchurch-lane, London, engineer. *For improvements in manufacturing wheat and other grain into meal and flour.* Patent dated June 5, 1849.

Mr. Bovill describes and claims,

1. A mode of making the bed-stone rotate instead of the top one, as has hitherto been usual.

2. A mode of fixing the top-stone and passing currents of air, either by exhaustion or pressure, between the grinding surfaces, and the application of ventilating pipes in the top-stone.

3. A mode of exhausting the dirty air from the case surrounding the stone chamber into which the meal is driven; and,

4. The employment of a porous fabric through which dirty air is passed, and which collects and retains the flour which was held in suspension by the dirty air or stive.

William Edward Newton, Chancery-lane, civil engineer. *For improvements in stoves, grates, or fire-places, and in warming or heating buildings.* (A communication.) Patent dated June 5, 1849.

The patentee describes and claims,

1. The employment of a transparent shield in front of the grate, which may be moved up or down, as required, to regulate the quantity of air admitted to the fuel, and consequently the draft.—(Query—If not identical with Nott's.)

2. A low-placed stove, recessed in the fire-place, fitted with a chamber in combination with a hood, for consuming smoke and the gases which are produced by combustion.

3. The combination in a stove of this description of a hood and smoke-chamber with an exterior casing, into which air is admitted and heated previously to its entry into the apartment.

4. An arrangement, for heating and warming buildings, of horizontal and vertical pipes, and smaller service-pipes, the essential feature of which is making the service-pipes, or sets thereof, communicate near their ends with the supply-pipes, so as to establish a constant circulation of hot water to and from the boiler.

5. The construction of a boiler for the purpose of the last head of this invention, which consists of a vertical fuel tube resting on the top of the incandescent mass in the furnace, and which is surrounded by a concentric tube, serving as a flue, which is enveloped by a concentric tubular boiler.

Elijah Slack, Orchard-street, Renfrew, North Britain, gun-manufacturer. *For improvements in the preparation of materials to be used in the manufacture of textile fabrics.* Patent dated June 2, 1849.

Mr. Slack's improvements have reference

generally to all fibrous substances, such as Kentucky hemp, Rrussian hemp, China flax and grass; but more particularly to the rendering of the coarser kinds which are imported in the partially-manufactured state of sheets, bags, packing, &c., and are capable of being further employed in the production of textile fabrics. These materials are first steeped for from five to seven hours in water, raised to a temperature of 80° to 120° Fahr.; after which they are boiled for a like period of time in a solution of lime, the proportion being 2½ lbs. of the latter to 100 lbs. of the material to be operated on. Instead of a solution of lime, some suitable caustic or alkaline solution, of a strength of from 1° to 3° Twaddle's hydrometer, may be used. The fibrous materials are then bleached, or decoloured by immersion for about six hours in a solution of chloride of lime, made of such a strength as that ½ or 2 measures will turn yellow 1 measure of blue liquid test, which is composed of 1 part indigo, 7 parts concentrated sulphuric acid, and 500 to 700 parts water; after which they are immersed in a solution of sulphuric or muriatic acid, of from 1° to 3° Twaddle's hydrometer. Lastly; the fibrous substances, in order to give them a ductile and silky character, are boiled in some oleagenous mixture, composed of 2 gallons of gallipoli oil and 1 gallon of a solution of caustic potash of 15° Twaddle's hydrometer. Two quarts of this composition are to be used to every 100 lbs. of the substance to be operated on; or a solution containing 6 or 7 lbs. of black animal or vegetable soap may be used to 100 lbs. of the substance.

Claim.—The preparation of materials, especially sheets, bags, and packing materials, to be employed in the manufacture of textile fabrics by the treatment and processes described.

JACQUES HULOT, Rue St. Joseph, Paris, manufacturer of fabrics. *For improvements in the manufacture of the fronts of shirts.* Patent dated June 5, 1849.

This invention consists in arranging the harness of the loom for working two warps and wefts (the bottom one being stouter than the top one), so as to produce an imitation of stitches in a fabric which is to be made up into shirt fronts.

Claim.—The manufacture of fabrics as described, and their application to shirt fronts.

THOMAS LAWES, City-road, gentleman. *For improvements in generating steam, and in the means of obtaining and applying motive power.* Patent dated June, 5, 1849.

Mr. Lawes' improvements in generating steam for motive power purposes consist in a peculiar combination of a boiler and furnace in one apparatus. The water is forced by a pump from a reservoir into a chamber, which forms the two sides and back of the furnace, whence it passes through a series of horizontal pipes placed in the flues, formed by brick partitions, over which the products of combustion pass and repass prior to escaping up the chimney; the steam generated in these horizontal pipes ascends into a series of vertical pipes, and passes thence into horizontal steam tubes, which serve the purpose of a steam chest, one of which is provided with a safety valve. To generate steam for cooking, boiling, &c., it is proposed to place two reservoirs of water on the hobb of an ordinary kitchen range, and to connect them by means of pipes, which answer the purpose of bars in the front and bottom of the stove.

The improvements in "obtaining and applying motive power" embrace,

1. A modification of a system of atmospheric propulsion, formerly patented by Mr. Lawes, and which consists in the substitution of a series of short tubes for one entire tube, reaching from end to end of the line. One end only of each length of tube is closed, and a partial vacuum is created therein by drawing a piston from the closed to the open end.

2. A method of applying motive power, placed in a boat or vessel floating in a canal, to a carriage with cog-wheels gearing into racks fixed by the sides of two rails on either bank of the canal, by means of one drum on the driving axle of the carriage, and another in the bow of the boat. The tractive power resulting therefrom is communicated from the carriage to the boat. And,

3. A mode of applying motive power to the tilling of land, by dragging a plough or harrow backwards and forwards over the surface of the soil.

THOMAS JOWETT, Burrage House, Bingley, York, stuff-manufacturer. *For certain improvements in the method of stopping power-looms, and preventing injury to the cloth, or fabric, in the course of being woven.* Patent dated June 5, 1849.

This invention consists in the substitution, for the ordinary finger, of a cranked lever keyed on the stop rod, the vertical end of which is in front of the shuttle-box, while the horizontal end takes into a slot in a bolt which slides up or down in a fixed guide, attached to the front of the slay, so that when the shuttle boxes, and the reed is beating up, the bolt is lifted above the level of the sliding frog, and slides over it without interfering with the further operation of the loom; but when the shuttle fails, or is absent from the box, and the swell takes into the shuttle-box, then the bolt will be depressed, and in course of beating up will come in contact with the sliding frog, which

is thereby forced against a spring lever, so as to cause it to take out of the notch the shifting rod, which is consequently free to act and shift the driving band from the fast to the loose pulley.

Osgood Field, London, merchant. *For improvements in anchors.* Patent dated June 5, 1849.

Mr. Field proposes to construct anchors for the purpose of preventing fouling from cables or ropes.

1. With a guard swivelled on the shank, which, when one fluke is buried in the mud, &c., is raised up so as to form an inclined surface from the extremity of that fluke to the point where it is swivelled to the shank.

2. With a guard in the shape of an equilateral triangle, which is attached by the centre of the base to the ring end of the shank, while the apex is attached to the centre of the shank.

3. With a guard in the shape of a rectangle, one end of which is hinged to the crown, so as to allow the other end to rest upon the mud, &c., and thereby prevent the cable from getting under the crown.

The patentee claims the three several modes of constructing anchors with guards, as described.

William Henry Smith, Fitzroy-square, civil engineer. *For certain improvements in breakwaters, beacons, and moorings; parts of which are applicable to other purposes.* Patent dated June 5, 1849.

1. Mr. Smith's improved breakwater is constructed of open frames, gratings, or, in some cases, of walls, in sections, which are hinged at bottom to piles, or other suitable foundations firmly fixed in the bed of the sea or river, so that they may turn on them as pivots or fulcra. To the top of each section on the sea side there is attached a vertical rod reaching nearly to the bottom, which is linked to a horizontal rod, the other end of which is made fast by a joint to a pile bedded in the bottom of the sea, and a weight is attached to the link. By this arrangement, the breakwater will offer a yielding resistance to the action of the waves, gradually absorbing their momentum by bending down until the two rods or braces are dragged into the same right line; and then, when the force of the wave is exhausted, the breakwater is brought back to its original position by the action of the weight. The frames may be filled-in with slate panelling to economize the material, and a gangway or tubular bridge constructed on the top. A space is left between the bottom of the breakwater and the bed of the sea, to allow of the ground current, the back-flow of which may be applied to the deepening of water-ways. Hurdles may be suspended, if deemed necessary, in front of the breakwater, which may be employed in the construction of groynes.

2. The "beacon" consists of a standard, carrying a signal at top, and hinged or pivoted at bottom on a pile firmly imbedded in the bottom of the sea, as before. Several braces, linked together in pairs, are attached at top to the standard, and at bottom to foundations or mooring anchors in the bed of the sea. To each link there is attached a chain or rope, which is made fast to a weight that slides up and down the standard. The chain is shortened sufficiently to cause the links in each pair to assume the appearance of an obtuse angle; and it follows from this arrangement, that when the standard is struck by a wave, it will bend back, dragging the braces on that side into right lines, and causing the weight to slide up. When the force of the wave is exhausted, the gravity of the central common weight will bring the standard and braces into their original position. The improved mooring apparatus consists in the employment of one of these weighted braces attached at one end to a foundation and at the other to a buoy.

3. The improved foundation consists of a pile, to the bottom of which there is pivoted a bar of iron, sharp at one end and bent up at the other. When the pile is driven into the bed of the sea, the loose part is almost in the same right line with the rest; but when it is attempted to pull it out, the loose part gradually assumes a horizontal position, or the line best calculated to offer the greatest amount of resistance to its withdrawal; or, the pile may have a twist given to the top of the lower part, which, when it is turned one way, will cause the pile to descend, and when turned the other way, will facilitate its withdrawal.

The patentee claims the various constructions and arrangements as described, and as illustrated by the drawings which accompany his specification.

Specification Due, but not Enrolled.

George Simpson, Buchanan-street, Glasgow, civil and mining engineer. *For a certain improvement or improvements in the machinery, or apparatus, or means of raising, lowering, supporting, moving, or transporting heavy bodies.* Patent dated June 5, 1849.

[The specification of this patent was presented for enrolment the day after it was due, and, of course, refused. We are curious to learn whether our Glasgow friend, who met with a similar mishap in the case of Hewitt's patent, was the party entrusted to prepare and enrol Mr. Simpson's specification.]

WEEKLY LIST OF NEW ENGLISH PATENTS.

Walter Crum, of Thornliebank, Renfrew, Scotland, for certain improvements in the finishing of woven fabrics. December 3; six months.

Conrad Montgomery, of the Army and Navy Club, St. James's-square, Middlesex, Esq., for improvements in brewing, distilling, and rectifying. December 3; six months.

William Eccles the elder, William Eccles the younger, and Henry Eccles, of Blackburn, Lancashire, cotton spinners, for certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton and other fibrous substances. December 3; six months.

Joseph Paradis, of Lyons, France, merchant, for improvements in the manufacture of elastic mattresses, cushions, and paddings; part of which improvements are applicable to other purposes where sudden or continuous pressure is required to be sustained or transmitted. (Being a communication.) December 3; six months.

George Buchanan, of Edinburgh, civil engineer, for improvements in cocks, valves, or stoppers, and in the use of flexible substances for regulating or stopping the passage of fluids, and also in making joints of tubes and pipes, or other vessels. December 3; six months.

Baron James Ulric Vancher de Strubing, of Margaret-street, Cavendish-square, Middlesex, for improvements in the manufacture of axletree-boxes for carriages, and of the bearings of the axles of railways, and in the making of an alloy of metal suitable for such and like purposes. December 3; six months.

George Edmond Donisthorpe, of Leeds, York, manufacturer, for improvements in wheels of locomotive carriages. December 3; six months.

Peter Fairbairn, of Leeds, York, machinist, and John Hetherington, of Manchester, for certain improvements in machinery for preparing and spinning cotton, flax, and other fibrous substances. December 3; six months.

Samuel Fisher, of Birmingham, Warwick, engineer, for improvements in railway carriages, wheels, axles, buffer and draw springs, and hinges for railway carriage and other doors. December 5; six months.

Edward Carter, of Merton Abbey, Surrey, machinist, for improvements in printing calico and other fabrics. December 5; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Nov. 27	2099	William Burgess	Blackfriars-road	Gutta percha hose joints.
28	2100	Francis Klamm	York-street, Commercial-road East	Rotary heel tip.
29	2101	William Murray	University-street	Compensating ball-lever.
Dec. 1	2102	William Broughton	South-street, Finsbury-market	Ne plus ultra stove.
3	2103	Richard Bell	Basing-lane	Metallic fusee box.
4	2104	Thomas Curry	Bristol	Configuration and arrangements of a steam boiler.
„	2105	John Cocker	Bolton	Brush.
„	2106	Samel Whitfield	Birmingham	Window cornice and cornice-pole.
5	2107	George Chance and John Bird	Kingsainford	Furnace grate.

Errata.—Page 511, *for* "Helvetius" *read* "Hevelius." Problem 7, *for* $\frac{1+2\sqrt{2}\sqrt{z-z^2}}{s}$ *read* $1+\frac{2\sqrt{2}\sqrt{z-z^2}}{s}$.

NOTICES TO CORRESPONDENTS.

Communications from Mr. Rock, Mr. Baddeley, and Mr. Maynard are in type, but unavoidably thrown out of their intended place in this week's No., in consequence of the great number of specifications that have fallen due since our last, and the pledge we have given to the public to give in each No. the substance of every specification enrolled during the preceding week.

I. F. E. *is requested to send to our office for a letter from a person who offers to supply him with the information he wants.*

L. R. E.—*We decline the interview (query wrangle?) requested. He can write what he has to say, or get some one to do it for him.*

CONTENTS OF THIS NUMBER.

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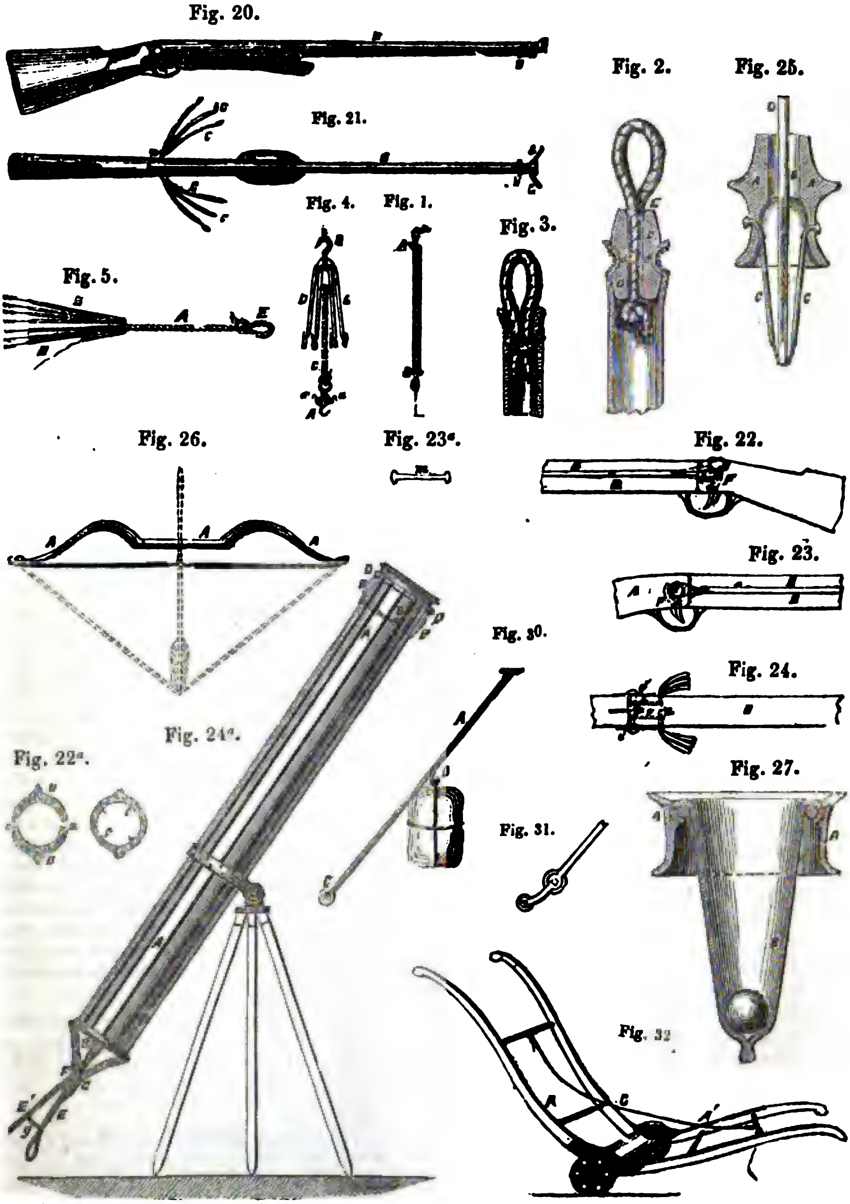
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1375.] SATURDAY, DECEMBER 15, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

MR. HODGES' PATENT MECHANICAL PURCHASES AND PROJECTILES.



MR. HODGES' PATENT MECHANICAL PURCHASES AND PROJECTILES.

(Patent dated May 27, 1849. Richard Edward Hodges, of Bycroft, Esq., Patentee. Specification enrolled November 29, 1849.)

NUMEROUS as the applications of caoutchouc have been, this patent affords a striking proof that we are far from having arrived at the last of the important uses, to which its extraordinary elasticity may be made subservient. Here we see it imparting a power to the bow which it never before possessed, and putting in a claim to rival even gunpowder in projectile force. The principle on which Mr. Hodges' very ingenious contrivances are founded will be readily understood from an inspection of fig. 1, of which this is his description:—

A B represents what I call a single purchase; it consists of a piece of vulcanized caoutchouc tubing, of about a foot in length, three-quarters of an inch outside diameter, half an inch bore, and about three ounces in weight. A piece of these dimensions, of good quality, will admit of being stretched, without overstraining or risk of breaking, to the length of six feet, by the application of a force of 65 lbs., which is not more than a man of medium strength may easily exert at a dead pull. Supposing, therefore, such a piece of tubing is loosely attached to any body (*a*) desired to be moved, and then drawn out to the above extent by a man's power, and made fast to another body (*b*), which is a fixture, as a post or tree, the piece will obviously exert a resilient force tending to the removal of the least resisting of the two bodies, *a* and *b*, exactly proportional to the force which was used to elongate it; and if a number of such purchases be applied in the same manner, there will be the power of as many men exerted to draw the body, *a*, as there are pieces applied. And in this way a single man may, by a succession of individual efforts, bring into operation upon any body desired to be moved, the power of a hundred or more men.

The inventor shows great modesty in speaking of one man being thus enabled to exert the power of only "a hundred men, or more;" for, according to our calculations, a thousand of such tubes as he describes (namely, one foot long, and three-quarters of an inch in diameter), would weigh no more than 250 lbs., and would pack up in a space equal to six cubic feet, and if placed on board of a ship of war, would, in many cases, be equal to an additional force of a thousand men — consuming no provisions, and always in prime working order,— ready for work at all hours, on board or on shore, and either collectively or separately.

Each purchase must necessarily have a hook, or loop, or ring, at each end—one by which it may be stretched, and another by which it may be made fast. Several ways of accomplishing this are described in the specification.

I stretch the end of the piece of tubing to about six or seven times its ordinary length, and whip the part which has been so extended round with tarred or waxed twine or wire, and then form the whipped part into a loop, making the turned-over end fast by countering in the usual way. Or I make use of a loop of twine attached to the elastic purchase, in the manner represented in fig. 2. D, is a hollow knob or carrier, of wood, which is turned to nearly the size of the internal bore of the elastic tube, and has a deep groove, *d*, all round the middle of it. E, is a cord or rope, which is knotted at one end, and then passed through the carrier, D, after which a loop to pull by, is formed on the other end. The elastic tube is then drawn tightly over the carrier, with the rope inside of it, until it comes over the groove, *d*, when it is whipped with twine or wire, which presses the material of the tube into the groove, and thereby makes the carrier immoveably fast, leaving the loop projecting from the end of the tube ready to be attached as required. Or, thirdly, a piece of cord looped at one end, and knotted and tapered off at the other end, may be directly passed through the tube (without the interposition of any carrier), as represented in fig. 3. The tube should be well stretched, and whipped round at the part between the eye and knob with wire or small cord, as before. Whichever of these modes of fitting the purchase with a loop is adopted, the loop may be strengthened by inserting a metal thimble into it, as in ordinary tackle.

Each tube or purchase is represented in fig. 1, as being of one foot only in length, and the patentee states this to be a good length for most practical purposes; but

The length may be increased to any extent which convenience may dictate, and, instead of the whole being of vulcanised caoutchouc,

it may be lengthened by the addition of a tail-piece of ordinary rope, or cord, or chain: and so also the strength of the tube may be increased to any required degree; but on this head it is important to observe that the strength of the tube, and, consequently, the amount of resilient force it exerts, is always in an exact ratio with the weight of the tube wholly irrespective of its diameter. When the strength of the tube is increased beyond the power of a man to stretch it out to the desired extent, then a number of men may be employed to draw out, through the intervention of any ordinary tackle, or even the power of horses or other animals may be employed for the purpose. Instead also of the purchases being made tubular, they may be made of solid vulcanised caoutchouc, either round or flat, or of any other shape, but I prefer the tubular form to any other. Fig. 4 shows the application of these purchases to hoisting tackle.

An exemplification of the application of a number of such purchases to the hauling of heavy bodies—to the case, for example, of a solitary colonist having his horse or cow to drag out of a pit, and which, but for some such mechanical assistance, he would be unable to accomplish, is given in fig. 5:

The body to be moved is connected to a rope, A, by an eye, E, and to this rope are attached a number of single purchases, BB, such as represented in fig. 1, and before described. A number of pegs are to be fixed in the ground at a little distance from the point of junction of the purchases with the rope, and well secured. The purchases are then successively drawn out by hand, and made fast to the pegs, and when the whole have been thus made fast, the body will be moved forward to a distance proportionate to the resilient force exerted, less the ground friction. The purchases are to be then released, and the pegs moved further forward, when the purchases are to be again made fast to them as before, and the body moved a further distance forward. And so by repeating the same round of operations as often as need may be, the body may be moved to any distance required; and this, whatever its weight may be, though but one hand only is required to conduct the operation.

Figs. 20 to 22, both inclusive, exhibit the application of these purchases to fowling-pieces, for which they are singularly well-adapted on account of their doing their lethel-work without *either noise or smell*. Fig. 20, is a side elevation of a piece of this description; and fig. 21, a plan; figs. 22 and 23, are side elevations; and fig. 24, a plan on an enlarged scale of those parts which correspond with the ordinary gun-lock.

A is the stock; B B, the barrel, which is composed of two concave pieces, or half cylinders, joined at the ends, but separated by a longitudinal groove or slot, *a a a*, on each side. A cross section of this barrel is given separately in fig. 22*; C C, are a number of elastic pieces similar to those before described, which are laid crosswise between the two halves of the barrel, and whipped together at the middle by cord, so as to be united into one at that part, and to be of a size somewhat less than the slots, *a a*, of the barrel. Each purchase has a loop, *c*, attached to the end of it, by which it may be hooked on, as afterwards explained, to one or other of two horns, G G, affixed to the muzzle of the piece. Two eyes, *e e*, are attached to the whipped or middle part of the purchases, and through these eyes, and through holes, *e′ e′*, made to correspond with them in the sides of the stock, a detent, *m*, of catgut, gutta percha, stiff cord, or other like substance, is passed. A view of the detent, *m*, detached from the gun, is given in fig. 23*. F, is a trigger knife, which being drawn in the same way as the trigger of an ordinary gun, cuts the detent in two, and allows the purchases to fly forward towards the end of the gun. In using this weapon, the whipped part, where the tubes are joined together, is first drawn back and made fast, as before described, by the detent, *m*; after which the missile is dropped down into the gun. The shooter then takes hold of one of the purchases by the loop, *c*, and, stretching it out, hooks it on to one of the horns, G; he then takes hold of another of the purchases, but on the opposite side of the barrel, and stretching it in like manner, hooks it on to the other horn, G. In the same way he stretches out the remainder of the purchases, and makes them fast to one or other of the horns; taking care always to attach each purchase to the horn on the same side with it. The discharge of the missile is then effected by drawing the trigger, which cuts the detent in two, and sets free the whole body of purchases, C C, which drive the missile before them with immense force. The whipped part of the purchases, or that part where they are united in one, catches near to the muzzle of the gun against an elastic stop, H, which prevents the purchases from doing any injury to the rigid parts at the end of the gun, or causing any unpleasant shock to the person handling it. Even shot may be discharged from such a weapon, by making it up in a cartridge, and affixing a small ring to the muzzle of the piece, having three or four projecting lance

points, *c c* (fig. 23[b]), to cut the paper of the cartridge as it is issuing from the muzzle, and thereby to disengage the shot. Instead of the arrangement before described for discharging the missiles, one more nearly resembling the lock of a common gun may be employed; as for instance, the purchases might be held back by a hook under the control of the tumbler, while the tumbler might be set free by the trigger.

Fig. 24[a] is an external elevation of another apparatus for discharging projectiles by elastic force, which is constructed on the same principle as the fowling piece. It is represented in the figure as supported by a standard, like a telescope, and so it would probably require to be when used for such purposes as harpooning whales or porpoises, or throwing ropes ashore or seaward in case of shipwreck; but there is obviously no reason why it should not be light enough to be used by the hand alone.

A A, is the barrel; B B, are a series of elastic purchases; C, a catch to which they are affixed in charging or preparing the apparatus; D D, are hooks to which the free ends of the elastic pieces are hooked. The discharge is effected in this case by grasping and pulling together the levers, E E^1, one of which has its fulcrum at F, and terminates at its shorter end in the catch, C, which holds the elastic purchases, B B, until ready to be discharged; *g*, is a locking piece, which must be drawn back before the lever, E^1, can be liberated. An apparatus of this sort would be very applicable for throwing ropes in cases of shipwreck, or for projecting balls, arrows, or signals.

Some farther illustrations of the application of these purchases to projectiles are given in figs. 25, 26, and 27:—

Fig. 25 represents another apparatus for throwing arrows, which may be held in the hand. A, is a wooden ferrule or cup, with a hole, B, passing right through it; C, is an elastic purchase, the two ends of which are fixed to the ferrule, A, by being passed through it as represented. D, is part of an arrow which is passed through the hole, B. When the arrow is drawn, the recoil from the elasticity of the purchase is sufficient to project the arrow to a great distance.

Fig. 26, represents a bow constructed on the same elastic principle. The arc, A, of the instrument is 18 inches long between the two ends, and consists of some rigid substance, such as metal pipe, &c., of a strength equal to sustaining a strain of, say 20 lbs. The chord or bowstring is made of vulcanised caoutchouc tubing, and in its unstretched state is about 9 inches long. This chord is first stretched at the centre to about five or six times its usual length, and whilst in that state whipped round with twine or covered wire. This forms the seat for the bottom of the arrow. The ends are then stretched, and whipped in like manner; after which they are formed into loops, and attached to the ends of the rigid piece in the usual manner. With such a bow as this, an arrow of 2 feet in length, and weighing about half an ounce, may be projected about 130 or 140 yards.

Fig. 27 is a sectional elevation of a hand sling for projecting stones, balls, &c. It consists of a metal or wooden ring, A, to which there is affixed a tapering tube, B, made of vulcanised India rubber, and closed at its lower end. The stone, or other object to be projected, is put into the tube, which is then extended by the one hand, while the ring, A, is held in the other; on letting go the end of the tube, the sudden spring or contraction of the tube causes the stone to be projected out of it with great violence.

Mr. Hodges' specification includes also some new purchases, not of the elastic class. Fig. 30 represents a very ingenious mode by which a common travelling staff may be made to relieve both back and hand:—

A, is a round staff with a cross handle, B; C, is a small wheel, fitted to the lower end; and D, a hook attached to the middle of the staff on to which the bundle or package is to be hooked. An instrument of this sort, of five feet in length, which is a good average length, weighs only about 2 lbs., and will enable a pedestrian to carry along with him a weight of from 40 to 50 lbs. with little more effort than that of holding up the stick at a fit angle of inclination for travelling. The staff may have two wheels fitted to it, one in advance of the other, as represented in fig. 31, the hind wheel being the larger of the two, whereby it may be moved over uneven ground with greater ease. Loads of even greater weight than 40 lbs. or 50 lbs. may be carried by an instrument of the same sort, by increasing the length and strength of the instrument; and they may be attached to the staff in various other convenient ways.

Fig 32, represents an improved handbarrow:

In this barrow two bearing frames, AA^1, with handles, are attached to the axle, B, of one pair of wheels, and connected lengthwise by a strap or chain, C. Two men with a barrow of this construction may do three

times the work which one man can do with a single barrow of the ordinary form The arms, AA¹, may be attached to the axis independently of each other.

Men accustomed to move heavy weights or barrows, will see at once that the second pair of handles—especially when the two pairs are attached independently of one another to the axle—must be of great use in producing a proper balance of the load, tending equally to prevent it from tilting or from bearing too heavily at particular points.

(For Claims, see *ante* p. 546.)

ON A CERTAIN "DIARY" QUESTION; ON QUADRUPLE ALGEBRA; AND ON ANALYTICAL GEOMETRY. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

Sir,—Perhaps the gentlemen named in the first of the accompanying fragments will be obliging enough to communicate to your Magazine the considerations by which they were led to ascertain the fact that the proposed equation of the fifth degree has a linear and rational divisor. Of course I do not wish to trouble them for, nor to encumber your columns with, the *details* of the operations, but merely to obtain such a statement of their processes as may enable those of your readers who take an interest in these subjects to learn what those processes were.

I am, Sir, yours, &c.,

JAMES COCKLE.

2, Pump-Court, Temple, December 6, 8849.

On a certain Diary Question.

In the *Lady's and Gentleman's Diary* for 1849, I proposed as a question the finite algebraic solution of a certain equation of the fifth degree. This question has, in the *Diary* for 1850, recently published, been answered by Dr. BURNS, of Rochester, Mr. T. BROWN, of Longhirst, Mr. J. C. LOWRY, of Walsall, and Mr. P. MULLANNY, of Rochdale, (see *Diary* for 1850, pp. 56, 57). I presume that their communications agree in respect to the co-efficients of the biquadratic, as given at the latter page.

Let

$$A = \frac{a^3 - 5b^3}{5ab}$$

then, those gentlemen have observed that the given equation is divisible by $x - A$. They have also given the biquadratic which results from the division. I now propose to point out a peculiar form taken by the co-efficients of that biquadratic.

Representing, as we may do, the last-mentioned equation by

$$x^4 + Ax^3 + Bx^2 + Cx + D = 0,$$

and making

$$\frac{a^3}{5b} = E,$$

we see that the following relations obtain, viz., that

$$B = A^2 + a,$$
$$C = A^3 + E,$$

and that the numerator of D may be derived from the expansion of

$$(a^3 + 5b^3)^4$$

by rejecting the binomial co-efficients.

Having indicated these relations, I shall not pursue the subject further here. But I venture to hope that the gentlemen above named will reply to the query contained in the note with which I have introduced this communication.

On Quadruple Algebra.

At a previous page (197) of the current (51st.) volume of the *Mechanics' Magazine* I have adverted to four systems of Quadruple Algebra. Some further remarks on those systems will be found in the *Philosophical Magazine* for the present month,* where I have exhibited the modular forms belonging to each of them. A few additional observations on Quadruple Algebra may not be altogether destitute of interest to your Mathematical readers.

It will be observed, first, that the QUATERNION differs from the other systems in respect of the unity of value of its modulus. That modulus admits of *one* value only. But the other systems each present us with a variety of expressions capable of fulfilling the requisite of a true modulus, viz., that the modulus of a product shall be the product of the moduli of the factors.

In the TESSARINE SYSTEM, by giving all possible values to the double sign ($\pm$), wherever found, in the expression for the true modulus, it will be seen that there

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* December, 1849. S. iii., vol xxxv. pp. 434—437

are *four* different expressions capable of fulfilling the office of a true modulus.

By a similar process of reasoning, it will be found that the COQUATERNION has *four* different expressions, each of which may indifferently be taken for its modulus.

In like manner it will be seen that a COTESSARINE has *eight* different expressions, each capable of serving it as a modulus.

The above four systems, although perhaps among the most strongly marked, do not comprize every possible system of Quadruple Algebra. Let α, β, and γ be the imaginaries, and a, b, c, d, any four real quantities; then we may conceive systems in which the square of each of the imaginaries shall be represented by an expression of the form

$$a+\alpha b+\beta c+\gamma d,$$

the real quantities being either positive, negative, or zero. When b, c, d, each vanish, and a is either positive or negative unity, we have the four systems already discussed. Other systems I do not now propose to consider.

Let me add, that there may be systems of Multiple Algebra which stand in the same relation to the abnormal systems as these latter systems do to ordinary algebra.

The essentially distinct and inconvertible nature of the modular expressions for different systems of Quadruple Algebra seems to indicate that those systems are incapable of being converted one into the other by any such transformations or substitutions as those by which in ordinary algebra imaginaries are sometimes employed in place of real quantities, and *vice versâ*, or by any similar or analogous operations. The same remark applies to all systems of Multiple Algebra.

On Analytical Geometry.

There are three well-marked divisions of analytical geometry, which may be denoted by the respective terms *algebraic geometry*, *co-ordinate geometry*, and *imaginary geometry*. We may confine the term algebraic geometry to those applications of algebra to geometry which do not involve the co-ordinate method, for which we are indebted to DESCARTES, nor the imaginary geometry, on which I propose to offer a few remarks further on.

In co-ordinate geometry, curves and surfaces are expressed by means of *equations*, the equations being *indeterminate* unless points are the subjects of representation. Thus, the equation

$$y=x^2,$$

in which x and y are dependent indeterminates, represents a parabola.

But, in imaginary geometry, an *equation* is not requisite for the representation of a curve or surface. Thus, x being undetermined, the expression

$$x+x^2\sqrt{-1}$$

will, as different values are given to x, denote points on a parabola. So, in imaginary geometry of three dimensions, a hyperbolic paraboloid may be represented by an expression of the form

$$\alpha x+\beta y+\gamma xy,$$

x and y being independent undetermined quantities. And any surface may be represented by a similar expression.

Perhaps the characteristics of the divisions of analytical geometry may be expressed thus:—In *algebraic geometry*, we have to deal in general only with determined or determinable quantities; in *co-ordinate* and in *imaginary geometry*, we are concerned with indeterminate quantities; and, in the last-mentioned division, surfaces, &c., are represented without *equations*.

J. COCKLE.

Postscript.—I am aware that the term "algebraic geometry" is used in the title of Mr. *Waud's* treatise. But the question is, whether it may not be desirable to restrict the meaning as above suggested.

GUTTA-PERCHA HOSE JOINT.

(Registered under the Act for the Protection of Articles of Utility. William Burgess, Blackfriar's-road, and Kingsmill Grove Key, Newgate-street, London, Proprietors.)

Few applications of that modern and remarkable substance, Gutta Percha, display so much ingenuity, or promise greater usefulness, than that shown in the annexed engravings; viz., a joint for connecting lengths of flexible hose with each other, or with apparatus for forcing or transmitting fluids. Fig. 1 is an external view of this joint, A being the male, and B the female members thereof. The male joint is formed with an angular groove or indent, around it at d, and the female

Fig. 1.

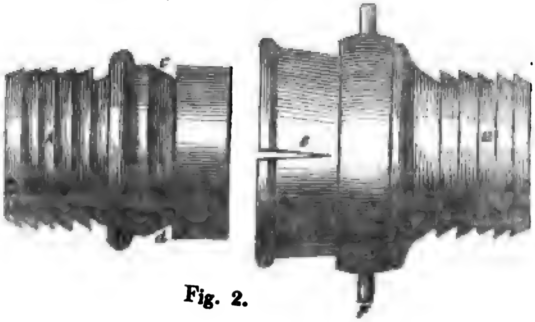
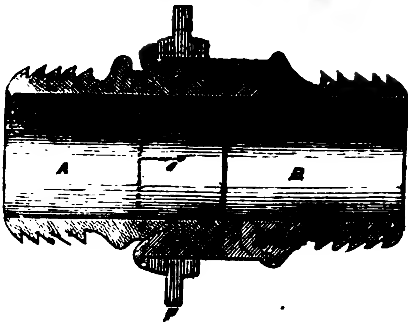


Fig. 2.



joint has a corresponding internal angular projection, which exactly fits into the groove, *c d*. The end of the female joint, B, has four equidistant slits (as at *e*), which allow it to expand, so as to slip over the cylindrical end of the male joint, until the projection falls into the groove, when the metal ring, F, being slid up to the end (as shown in the section, fig. 2), the joint is secured. On drawing back the ring, F, the gutta percha springs open, and the joint is easily separated.

The daily-increasing use of liquid manures by agriculturists, has created a demand for large quantities of flexible hose, as well as a cheap and expeditious mode of connection. The woven canvass hose is found to be best adapted for this purpose, but the price hitherto charged for it (under a supposed monopoly*) has been so exorbitant, and the brass screws for uniting it so expensive, that greater economy in these matters has been imperatively called for. Mr. K. G. Key has perfected arrangements for manufacturing woven canvas hose, and supplying it at about one-third of the present market price; and the gutta percha hose joint comes in most opportunely for making the required connections, as the employment of this material, in lieu of metal screws, will effect a saving of at least three-fourths both in the *weight* and *cost* of the joints. Gutta percha not being injuriously acted upon by the liquid manure, these joints will be very durable, and the small value of the material holds out but little temptation to steal them.

B,

* The canvas hose, although included in Vaucher's *specification*, is not in *the title* of his *Patent*; besides which, the manufacture of woven linen hose, both in England and Germany, has existed for upwards of a century prior to the date of Vaucher's patent.

FONTAINEMOREAU'S PATENT JACQUARD LOOM.

(Concluded from page 508.)

Fig. 2ª.

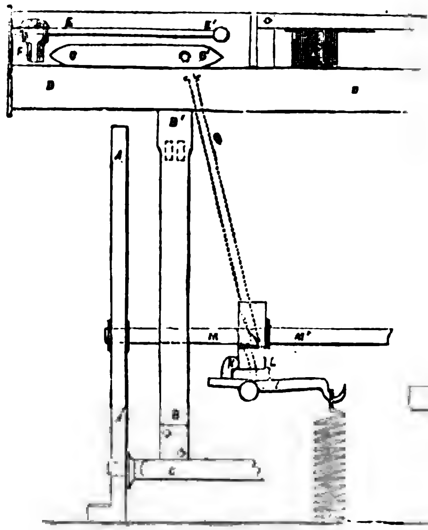


Fig. 1ª.

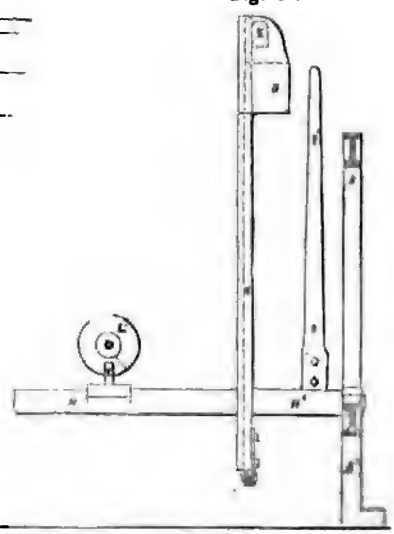
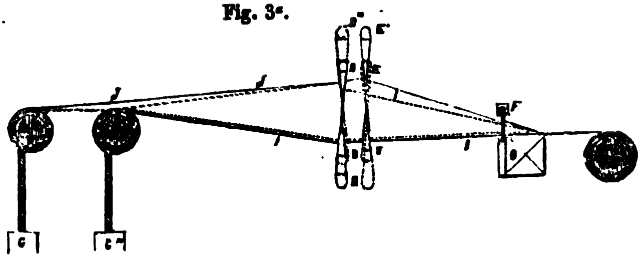


Fig. 3ª.



In all power looms, one of the essential conditions for their working satisfactorily, is the obtaining and maintaining the most perfect regularity in the action of the working parts. When these conditions are not fulfilled, or when the speed exceeds or falls short of the mean velocity, the work does not proceed with the requisite safety and regularity. And the object of the second part of this invention is to obviate these inconveniences by the following new arrangement for throwing the shuttle, which is represented in figs. 1ª and 2ª.

A A, A′ A′, represent the frame of the loom; B B′, the supporters of the batten; C, the axis of the batten; D D, the batten of the loom; E E, iron rods, on which the tappet slides; F F, tappets to throw the shuttle G, which is represented as being on the point of being shot; H H, arbor to give an up-and-down motion to the lever by which the shuttle is shot.

I a bent lever, which is put in motion by another lever, O O′, actuated by the spiral spring, J, which is regulated, as to its power, according to the motion desired to be given to the shuttle.

K, hammer bearing on the motive plate, L, and keyed on the arbor H.

M M, axis set in the frame of the loom, to transmit motion to the different parts of the loom.

N, the reed; O, lever, which receives motion from the hammer, K, and communicates it to the tappets, F F, by means of straps.

The motive plate, L, is provided with a notch, the depth of which is regulated according to the range through which the lever, O, is to travel; and the spiral spring, J, causes

the hammer, K, to bear continually on the motive plate, L, so that when the hammer faces the notch, it falls therein, taking with it the arbor, O, and the tappet, F, and communicates motion to the shuttle, G. The power which causes the motion of the shuttle, G, depends upon the force of the spiral spring, J, and cannot vary, whatever may be the velocity of the loom; and the shuttle, G, will always start with the same force, and will reach the same point without fear of breaking the threads or of remaining in the shed. The spring, J, may be replaced by any other motive power independent of that of the loom.

The third part of this invention relates to a new mode of winding the warp. The threads of the warp for plain tissues have generally been wound on the same roller, which is attended with the following inconveniences: — The threads are continually crossing each other over the same roller, and are consequently easily entangled and broken. The angle formed by the two series of threads with the tangent not being the same, the threads are not equally distended. The weights holding the roller bear on the lower half of the threads, whilst those of the upper part are too loose, which renders them liable to be being broken by the action of the shuttle.

Fig. 3ᵃ is a sectional elevation of this new mode of winding up the warp. A, is the roller, on which is placed the threads of the warp corresponding to the leash, D; C′ C′, weights to keep the rollers, A and B, distended. D′ D′, show the lower position of the treadle and leash, D D.

E E′, treadle and leash crossing D D.

F, is the reed; G, the batten of the loom; H, the roller on which the fabric is wound; I I, warp threads of the roller, B, the uppermost of which is indicated by I′.

J J, threads of the roller, A.

Each of the threads of the warps corresponding to one of the treadles, D D″ and E E″, is wound over a cylinder corresponding to A or B, and the treadles are kept distended by reason of their weight always acting in the same direction on the threads, whatever may be their position; and the threads being kept apart from the beginning of the operation, have no longer a tendency to become entangled, and consequently there is not the same danger of the shuttle meeting with any of them during its traverse.

ON THE STRUCTURAL CHANGES IN IRON FROM VIBRATION AND CONCUSSION.

Sir,—I should be much surprised at the manner in which Mr. Stephenson controverted Mr. McConnell's deductions as to the structural changes of iron under mechanical action, at the last meeting of the Institution of Mechanical Engineers, were it not so evident that a large portion of Mr. S.'s future fame is staked upon the assumed correctness of the views which he then enunciated. I allude to the Tubular Bridge, the durability of which, of course, depends upon the chance (for I cannot call it the certainty) of iron retaining always its fibrous structure, although subjected to often-repeated vibration. As I have paid some attention to this particular subject (see *Mech. Mag.*, vol. xlvii., p. 624), I have been much interested in the discussion which arose on the occasion already alluded to; and although I am quite convinced that change does take place in the structure of iron under certain mechanical action, I am glad that Mr. Henry Smith has promised "to furnish some results of cold-hammering iron at the next meeting." I would take the liberty of suggesting to him, or to any one else who takes an interest in the matter, a repetition of the experiment which I mentioned in my article on railway axles, in your Journal (vol. xlvii., p. 626). I might be wrong in the inferences which I drew from the result of that experiment, but I think that it offers conclusive evidence that iron may be changed from the fibrous to the crystalline state by "interrupted vibration." (Your printer made the mistake of putting the word "*uninterrupted*," instead of "interrupted," which altered the whole sense of my argument). Since I first made the experiment, I have repeated it many times, and invariably with the same results. A piece of square iron shows the effect best. On one occasion, I took a piece of half-inch slit nail-rod, and placing it on an anvil, with its convex side upwards, broke it by bending it over the edge of the anvil, by successive blows, *all in one direction*, that is, without turning the iron. The fracture showed a perfectly fibrous structure at the upper part, but the lower part—that next to the anvil—was perfectly crystalline to about an eighth of an inch in. On showing it to the smith who stood by, he said, "Oh, that nail-rod is always toughest on the round side."—"Well, then," I said, "try it the opposite way." He did so, and the effect was exactly the same as in the former instance; thus proving that a change of structure is actually produced by a particular kind of mechanical action. The

same results will be seen if the iron is fixed in a vice. If iron so fixed be broken by blows, *in alternate directions*, the crystals will be found on both sides, but in fewer numbers. Thus it will appear that the structural change may be determined to particular parts almost at will. I have made some experiments which seem to show that, under some circumstances, cold iron may resume its fibrous structure after having been partially crystallized; but I would not speak certainly on this point. My experience in carriage iron-work, which is probably subjected to more destructive strains than any other, shows me that iron is a substance which is continually changing in its character when subjected to irregular mechanical action, as well as to changes of temperature.

Every coach-smith can furnish instances of pieces of iron work which he cannot "get to stand." I may mention one—the lined axle stay of a "C" spring carriage, which is fixed to the perch at both ends, and clips the axle at the middle; it breaks in the round part where it is free, between the axle and the perch, and I have known such a stay break in the same place repeatedly (on London stones), although every precaution has been used, in the choice of iron, and by annealing; the fracture every time being crystalline throughout.

It appears to me that the instances of vibration adduced by Mr. Stephenson and Mr. Slate, viz., pump rods and engine beams—are not at all parallel cases to that of a railway axle; and Mr. Stephenson seems to admit this (if he does not at the same time concede the whole point at issue), when he says (p. 468), "The axles rarely, if ever, broke in the middle, but generally at the end, close to the boss of the wheel, because of the sudden change in the elasticity of the axle at that point; the portion of the axle fixed within the boss of the wheel being very rigid, while the rest remained elastic, which caused the vibrations to be suddenly checked at that point."

What is this but an admission that "interrupted vibration," or, in another word, "jarring" (certainly a mechanical action), produces molecular change in the structure of the iron, since fracture can hardly be shown to have resulted from a single concussion or strain, but rather from the action of successive concussions, leaving their effects at a particular place; where they accumulate until they arrive at a destructive quantity—that is, till the iron is so far weakened as to be beneath its work as to strength; and I suppose that in such cases, "fracture" and "crystallization" may almost be taken as convertible terms, or at least as constant concomitants; wherever there is fracture, there is crystallization; wherever there is crystallization, there fracture takes place.

In the discussion which has occasioned these few remarks, the distinction between vibration of mass, and vibration of molecules appears not to have been very clearly seen.

A mass, vibrating, or moving "bodily" in alternate directions, as an engine beam, for instance, has all its molecules on one side in a state of tension, and those on the other side in a state of compression, the sides changing alternately; but the force employed, relatively to the strength of the beam, is never, probably, sufficient to overcome the elastic resistance of any of its particles, so as to separate them, or alter their arrangement. The action is always similar, comparatively slow, and never excessive, and besides, it is generally smooth, viz., not jarring, or irregular. The same with regard to pump rods, although the application of the principle may be somewhat different.

But let a beam or rod, work jarringly, or let it be struck with a hammer, or other hard substance, vibration then takes place, but it is not *simple*, as in the former case—it is *compound* vibration. There is, first the vibration or motion of the mass due to the weight of the blow taken relatively to the weight and density of the mass, and there is besides, an internal vibration of molecules, that which causes "ringing" in a piece of metal, and which depends partly on the relative hardness of the metal, and that with which it is struck. In an elastic substance, such as iron, the molecules which immediately receive the blow, transmit its effect repulsively to the surrounding molecules in all directions, and the consequence of such an effect, complicated by the want of perfect homogenity in the mass, and by differences of position (some parts possibly being free and others fixed), can hardly be any other than a change of structural arrangement. I am, Sir, yours, &c.

James Rock, Jun.

SHORT METHOD OF FINDING THE LEAST COMMON MULTIPLE OF A SET OF NUMBERS.

Sir,—Having been a good deal occupied in the revision of books on arithmetic, my attention has been often directed to different methods of finding the least common multiple of a set of numbers; and I have, in consequence, been recently led to a rule for that purpose, which I think will be found to abridge the ordinary work. If you consider the topic as one likely to interest any of your readers, you will perhaps do me the favour to give insertion to it in the *Mechanics' Magazine.*

The rule is as follows:

RULE.

First.—Having arranged all the numbers in a row, cancel those which *exactly* divide any of the others.

Second.—Select from the numbers which remain *that one* which appears to contain the greatest number of different factors, and divide all the uncancelled numbers by the highest product possible formed from these factors, putting down the quotients for a second row.

Third.—Treat this second row as the first; that is, cancel every number which *exactly* divides any of the others. Then, if the uncancelled numbers in this second row be all prime to one another, the operation will be finished; for if they and the selected number be all multiplied together, the product will be the least common multiple. Should the uncancelled numbers in the second row be not all prime to one another, then we may conclude that an unsuitable number has been selected, and another number, taken from the given numbers, must be used instead, always taking that which offers the greatest number of different factors.

The operation by this method, even in unfavourable cases, will be found much shorter than the common methods, as will be seen by the following examples taken from various sources, which will sufficiently illustrate the above Rule:

(*Ex.* 1.) Find the least number that can be divided by 5, 6, 9, 15, 24, 27, and 126.*

The factors for 126 = 7 × 3 × 3 × 2 126)5′. 6′. 9′. 15. 24. 27. 126.
.. .. .. 15. 4. 3′. ..

Therefore 126 × 15 × 4 = 7560 the number required.

(*Ex.* 2.) Required the least common multiple of 7, 12, 15, 27, 35, 40, and 45.

45)7′. 12. 15′. 27. 35. 40. 45.
.. 4′. .. 3. 7. 8. ..
∴ 45 × 3 × 7 × 8 = 7560 = *Ans.*

(*Ex.* 3.) What is the least common multiple of 8, 9, 10, 12, 25, 32, 75, and 80.

75)8′. 9. 10′. 12. 25′. 32. 75. 80.
.. 3. .. 4′. .. 32. .. 16′.
∴ 75 × 3 × 32 = 7200 = *Ans.*

In the following example an unsuitable number is purposely chosen, in which it will be seen that the uncancelled numbers in the second row are *not* prime to each other.

(*Ex.* 4.) Find the least common multiple of 7, 15, 21, 28, 35, 100, and 125.

125)7′. 15. 21. 28. 35. 100. 125.
.. 3′. 21. 28. 7′. 4′. ..

Here it will be perceived that 21 and 28 are not prime to each other, as 7 will divide them both; consequently the chosen number, 125, is not the right one; the proper number that should be chosen is 100.

I remain, Sir, yours, &c.,

SAMUEL MAYNARD.

8, Earl's-court, Leicester-square, London, Nov. 24, 1849.

* The numbers here marked with a *dash* are understood to be *cancelled.* In working an example on paper, the better way is to draw the pen through the number, to imply that it is expunged; in *print* this is inconvenient, as a peculiar type is necessary. In the above operations, only a single dash is used, however many figures the number to be cancelled may consist of.

THE COTTAGER'S STOVE.

[Registered under the Act for the Protection of Articles of Utility. John Grant, of Hyde Park-street, Esq., proprietor.]

Fig. 3.

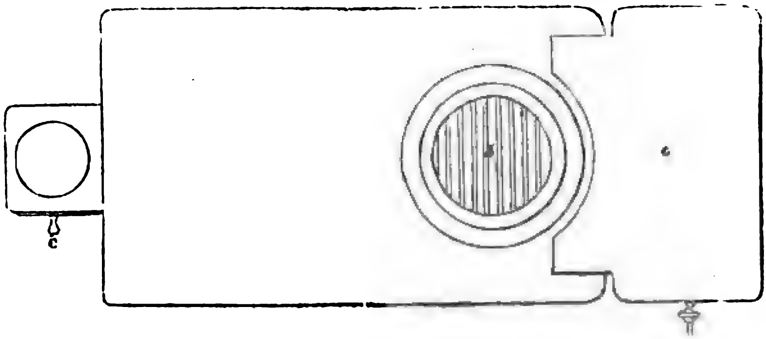
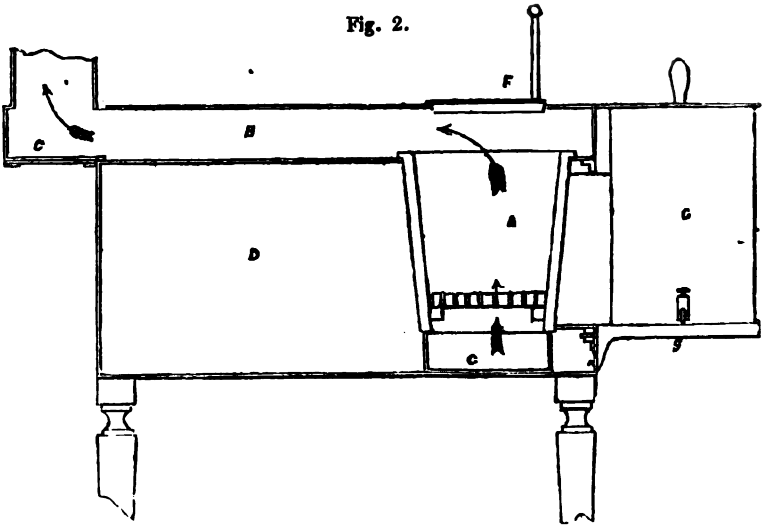


Fig. 2.



The designer of this stove states, in an address to the public, that "he had for his object the placing within reach of the working classes a simple, economical, and efficient cooking stove at the smallest possible cost;" and as a proof of the philanthropic motives by which he has been actuated, he adds that "the whole profit which may be derived from it will be invested in shares" of that admirable institution, "The Metropolitan Association for Improving the Dwellings of the Industrious Classes."

It is constructed on the principle of the common fire-pot, and the designer "having carried that principle out on an extended scale in his own establishment, "recommends it with confidence for simplicity, efficiency, and economy."

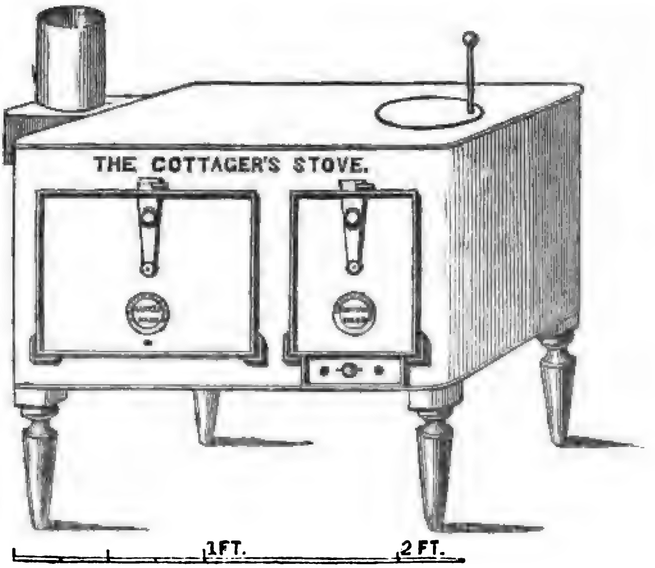
Fig. 1, is a perspective view of the stove; fig. 2, a sectional elevation of it; and fig. 3, a top plan.

A, is the fire-pot.

B, flue.

C, soot door.

Fig. 1.



D, oven.
E, ash drawer.
F, cover to fire-pot.
H, moveable panel.

The stove may be made either of cast or wrought iron, and with any degree of ornament desired, though, of course, at an increase of price. It may also have a steam boiler attached to it, as shown at G, in fig. 2; a bracket, J, being attached to support the boiler.

Messrs. Bailey and Co., the eminent founders of High Holborn, have undertaken the manufacture of this stove.

THE NAVAL MANUAL OF SCIENTIFIC INQUIRY.*

"The powers that be" are commonly so intensely engaged in taking care of number one, and other mere party matters, that the claims of science, unless they happen to assist the ruling objects, are despised or unheeded. When, therefore, a prominent member of the "lucky *élite*" steps out of the beaten track of official engrossments, and endeavours to make the commanding post which he holds instrumental in advancing knowledge and enlightening his countrymen—he deserves our esteem, and is fairly entitled to public gratitude. Such esteem and gratitude would appear to be justly due to the memory of the late lamented Lord Auckland, to whose enlightened zeal for the improvement of science, the editor says, this work owes its original conception.

It requires no lengthened argument to prove that a manual containing well-considered instructions for making scientific observations and inquiries would be most useful and valuable to the voyager and traveller, to whom an apposite suggestion at the proper time and place may be attended with the happiest results. A *vade mecum* of condensed directions on scientific subjects, to men in such positions, may not unaptly be compared to the packets of essences

* A "Manual of Scientific Inquiry;" Prepared for the use of Her Majesty's Navy, and adapted for Travellers in general. Edited by Sir John F. W. Herschel, Bart. Published by Authority of the Lords Commissioners of the Admiralty: John Murray.

which they often carry to supply the requirements of the body; each forms vital nutrition, which may be of inestimable value, because just at a particular juncture, it may be absolutely necessary, and no other, perhaps, could be obtained.

Such a handbook, however, is not only calculated to be of use to the sailor or traveller—it is obvious that it must be almost equally serviceable to that large class of our countrymen whose pecuniary means are not at all commensurate with their love of knowledge. Scientific instruction, the best of the kind, in the smallest space and at the cheapest rate, is quite as valuable and welcome to the solitary student at home as to the traveller abroad. In this point of view we consider the volume before us. The title would seem to indicate that the book is exclusively professional or official; we assure our readers that it contains a rich and varied store of information for every class of English students. The work, it appears, was founded upon the following *Memorandum*, issued by the Lords Commissioners of the Admiralty when Lord Auckland presided over their deliberations.

"It is the opinion of the Lords Commissioners of the Admiralty, that it would be to the honour and advantage of the Navy, and conduce to the general interests of science, if new facilities and encouragement were given to the collection of information upon scientific subjects by the officers, and more particularly by the medical officers, of Her Majesty's Navy, when upon foreign service; and their Lordships are desirious that for this purpose a manual be compiled, giving general instructions for observation, and for record in various branches of science. Their Lordships do not consider it necessary that this manual should be one of very deep and abstruse research. Its directions should not require the use of nice apparatus and instruments; they should be generally plain, so that men merely of good intelligence and fair acquirement may be able to act upon them; yet, in pointing out objects, and methods of observation and record, they might still serve as a guide to officers of high attainment: and it will be for their Lordships to consider whether some pecuniary reward or promotion may not be given to those who succeed in producing eminently useful results."

* * * *

The Memorandum further states that their Lordships' wishes would be best met if they could obtain the assistance of our most eminent men of science in the composing, by each, of a plain and concise chapter upon the head of inquiry with which he might be most conversant; and they have been readily and kindly promised the advice and labour of Sir John Herschel in revising the whole and preparing it for publication. The several heads of inquiry are as follows:—

Astronomy.
Botany.
Geography and Hydrography.
Geology.
Mineralogy.
Magnetism.
Meteorology.
Statistics.
Tides.
Zoology.

The Preface by the Editor simply gives the reasons which have necessitated what may appear to be in a certain degree departures from the plan sketched out in the Memorandum. The contents are, in addition to the *Memorandum* and the Preface,

Astronomy. By G. B. Airy, Esq.
Magnetism. By Lieut.-Colonel Sabine, R.A.
Hydrography. By Captain Beachey.
Tides. By Rev. Dr. Whewell.
Geography. By W. I. Hamilton, Esq.
Geology. By Charles Darwin, Esq.
Earthquakes. By R. Mallet, Esq.
Mineralogy. By Sir H. T. De La Beche.
Meteorology. By Sir J. F. W. Herschel, Bart.
Atmospheric Waves. By W. R. Birt, Esq.
Zoology. By Richard Owen, Esq.
Botany. By Sir W. Hooker.
Ethnology. By Dr. Pritchard.
Medicine and Medical Statistics. By Dr. Bryson.

Statistics. By G. R. Porter, Esq.
Appendix.

A cursory perusal of the foregoing list of names is sufficient proof that the praiseworthy Memorandum of the Lords of the Admiralty was met in a becoming spirit by our men of science. The list comprises many names of high and deserved celebrity: each author has (with an exception or two) distinguished himself in the subject on which he writes.

When each member of a body of such men has been induced, almost by their country's request, to contribute a condensed epitome of his knowledge of the topic on which his fame rests—to point out the best modes of observing any peculiarities or common properties belonging to it; and having done this, then for all to submit their labours to the editorial arrangement and revision of such a man as Sir John Herschel, it would be unaccountable if the result were not highly valuable and singularly efficient. Taken as a whole, we think the work deserves to be so characterized. But, considering that the commendable scheme originated with the Admiralty, "for the honour and advantage of the navy," that the Astronomer Royal is, officially, one of the Admiralty, holding their most important scientific post,—that much of the navigator's success and safety depend upon his knowledge and practice of nautical astronomy;—taking all this into account, we confess we were not a little disappointed at the very insignificant portion of the work devoted to Astronomy. The volume contains nearly five hundred pages; the ADMIRALTY'S HIGHEST SCIENTIFIC OFFICER has produced an article that occupies just NINE of those pages! that is, eight whole pages and two half ones! The Admiralty's scientific chief has contributed about as much matter for the benefit of the navy as would fill the tenth part of one of Pinnock's catechisms (we have no fault to find with the quality of the instruction comprised in this part; we only remark upon the extreme minuteness of the modicum.) No writer is more capable of furnishing the Lords of the Admiralty with a manual on astronomy that would be to the "*honour and advantage of the navy*," than is their own chief scientific officer. Was it, then, his *official duty* to do his best towards carrying out their Lordships' views with respect to his own peculiar department? We think it was; and we are of opinion that the Astronomer Royal has not made the article on astronomy what it ought to have been. The editor, in an appendix and notes, has added quite a FOURTH to its length—still the article is a meagre one.

It is said that financial reformers intend to examine pretty closely the staff of our public departments, and that if they find an office with a chief paid rather liberally from the public taxes, who has time enough to do any one's work besides or except his own, they will recommend the abolition of such office. How would this rule, if carried into effect, operate upon the apparently anomalous office of Astronomer Royal? We give no opinion: perhaps "*Ne sutor, &c.*," applies; if it do, the Astronomer Royal has not forgotten his Latin. The moral gives a hint which commission-makers may consider. Our readers, however, may be assured that, notwithstanding the OFFICIAL shortcomings we have named, the volume comprises a large quantity of really valuable information. It is neatly printed, handsomely got up, and of considerable bulk; and we are of opinion that the British public is highly indebted to the Admiralty for so interesting a work at so cheap a rate.

ARGAND CANDLES.

Sir,—Your correspondent, Mr. D. Mackie (page 521), is right in describing the construction of Argand candles as a very old "*idea*," but he is very wrong in supposing that "no great stretch of inventive faculty is necessary to transfer the principle from the flame of a lamp to that of a candle." The attempt to work out this "*idea*" has occupied many ingenious minds, since Messrs. Desormeaux and Hutchings, in Oct., 1805, took out a patent for candles upon the Argand principle. Twenty years afterwards similar candles were the subject, in part, of a patent taken out by Gay Lussac. Of

these numerous experimentalists many have been very near, but have not quite surmounted the practical difficulties of the case. The application of the Argand principle to a candle with any prospect of success requires that the wick as burned should be dissipated without snuffing, that the tallow should not be melted too fast, and above all, that it should not run down and choke the central opening—three contingencies not *easily* provided for.

It remains to be seen how far Mr. Crossley's patented improvements meet the requirements of the case; having paid very considerable attention to this particular subject, I fancy another link is yet wanting to complete the chain and perfect the improvement, and whether I have hit upon the right one would be premature to say. It is said in Hebert's "Engineers' Cyclopedia" that "a large manufactory was commenced for the purpose of making Mr. Desormeaux's patented article, with every probability of success, and that the reason why the manufacture was not carried forward had no reference to the practicability of the scheme! On this point, however, I am very sceptical. I can, however, agree with the opinion therein expressed, "that important results may yet flow from prosecuting this plan, if undertaken by some intelligent person."

I remain, Sir, yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington, Dec. 3, 1849.

POSITION OF THE AIR-VESSEL IN PUMPS.

Sir,—The inquiry of your correspondent, Mr. Hulse (at page 521), is not very intelligible. An air-vessel is applicable only to *forcing-pumps*, and must be applied to the *delivery main*, but whether above or below the working barrel is quite immaterial. I am inclined to think Mr. Hulse's inquiry has reference to a common open topped lift pump, to which an air-vessel is inapplicable; neither would it remedy the evil complained off—"the shock experienced both at the lift and return of the bucket, but more particularly at the lift." I strongly suspect this evil arises from a contracted water-way in the feed pipe or valves, which can only be got rid of by enlarging the water ways, or by giving a slower motion to the pump bucket. Should this explanation not meet the exigency of Mr. Hulse's case, I shall be happy on receiving "further particulars," to "try again."

I remain, Sir, your obedient servant,

WM. BADDELEY.

29, Alfred-street, Islington, Dec. 4, 1849.

AIR-VESSELS OF PUMPS.

Sir, — I observe, in a recent number, that one of your readers, Mr. Hulse, wants to know the best place to fix an air-vessel to a pump—whether it should be above or below the working barrel? It is not possible to answer this question properly unless Mr. Hulse will state the length of the suction-pipe—as, if this be long, running, for instance, in a horizontal position for a considerable distance, an air-vessel should most certainly be placed (say) six or eight feet below or from the lower clack or valve. The reason of this is, that a very long column of water does not like to be either *stopped* or *started* suddenly. The air-vessel, therefore, in this case, allows the water when in motion to rise in it; and on the bucket ascending, the first water is taken out of the air-vessel; so that, in fact, the water in the suction-pipe is *always* moving towards the pump, even when the bucket is descending. Should, however, the suction-pipe be vertical, and (say) 26 feet long, and the raising main of considerable height or horizontal length, then the air-vessel should be placed immediately above the upper clack. It is, however, always good practice to place an air-vessel both above and below the working barrels of pumps, where the pipes are unusually long.

I am, Sir, yours, &c.,

A LONDON ENGINEER.

London, December 5, 1849.

THE PARIS DENTISTS' COPPER AMALGAM.*

In Paris some dentists use an amalgam of copper with great advantage, to fill the cavities of carious teeth; it is sold in little cakes of about four grammes, costing two francs each. The colour is grayish; it is very hard, and adheres so firmly together as to require a powerful stroke of a hammer to break it. It is of a finely granular crystalline texture. The sample I examined consisted of 30 parts of copper and 70 of mercury. When heated to the boiling point of mercury, it swells a little, and a few

* From an article by Dr. Pettenkofer in the *Annalen der Chemie und Pharmacie*, as translated in the *Chemist*, by C. and J. Watt. No. II. New Series, November, 1849. We are glad to see this well-planned journal revived, and hope it has a long career of success before it. May we be excused for hinting that its chances of prosperity would not be at all lessened, by a more careful habit of reference to the sources from which its information is derived? One of the principal departments of the present number is headed, "Specifications of Patents Recently Enrolled;" and the whole of this department is copied *literatim et verbatim* from the *Mech. Mag.*, without the slightest word of acknowledgment!!

drops of mercury to appear on the surface. Being triturated for some time in a mortar and cooled, it is as soft as moist clay. In this state it can be pressed into the smallest cavities. After a few hours it becomes so hard, that a sharp-edged piece will engrave upon tin and cut bone. When soft, a very liquid amalgam of copper and mercury can be expressed by a powerful pressure between the fingers. The specific gravity in the soft and hard state differs little.

This metallic compound is an interesting example of the effects of crystallization and amorphism on the properties of bodies. When soft, it shows not a trace of crystallization. It can be spread with a knife like plaster, but when hard it is very brittle; thin layers break like glass, and the fracture is granular crystalline. Among metals, this copper amalgam is the first-known example of two states of a body at the same temperature; and is as instructive as the elastic amorphous sulphur and the brittle stick sulphur amongst the metalloids. It is a most valuable property for the purposes of the dentist, that the specific gravity should not vary in the transition from the amorphous into the crystalline state, as the mass when hard occupies exactly the same space as when soft. I have pressed the soft amalgam into glass tubes, and when cold it formed a perfectly air-tight stopper.

I have prepared amalgams containing between 25 and 33 per cent. of copper; all became crystalline after heating: those containing most copper solidified more quickly, and became much harder than those containing less. Alloys of 25 parts copper and 75 mercury required three days to become completely crystalline. There is no atomic proportion between the copper and mercury in these crystalline compounds any more than between the constituents of other metallic alloys. A combination of 1 equivalent copper with 1 equivalent mercury would require in 100 parts 23·8 copper and 76·2 mercury. Perfectly analagous compounds occur in the native silver crystalline amalgams; by analysis their amount of silver varies between 25 and 86 per cent. Two metals crystallizing together proves them to be isomorphous. This is the case with copper, silver, gold and mercury.

This copper amalgam is likewise an interesting example of the transference of the state of aggregation from one body to another; the liquid mercury, with the solid copper, passes into a firm crystalline state, which it can only assume at a very low temperature, if alone; as many solid salts become liquid by contact with water.

Having tried several plans, I found the following the best:—A weighed quantity of mercury is dissolved in boiling sulphuric acid, and the resulting crystalline paste of protoxide and peroxide of mercury, triturated with finely-divided metallic copper in a mortar with water, at 140° to 158° F., for some length of time. There must be sufficient copper, 1st, to reduce all the mercury; and, 2nd, that enough copper may amalgamate with the mercury. Copper obtained by reducing the oxide in hydrogen is the best, but that precipitated by iron from sulphate of copper will do. The plastic mass, well washed, is put into a leather bag, and as much mercury as possible is pressed out; it is then formed into little cakes, and in a few hours hardens to a mass, the fracture of which resembles in appearance the brittle alloy of lead and gold.

This amalgam is useful to stop machines and chemical apparatus, where cork, glass, &c., cannot be used; it will, probably, likewise be of service to artists and surgeons.

[An editorial note states that this amalgam may be made with ease by moistening finely-divided copper, precipitated from a solution of sulphate of iron, with proto-nitrate of mercury, in a porcelain mortar, pouring on it boiling water and metallic mercury, and triturating it for some time. The at first brittle mass soon becomes soft, and when the right quantity of mercury has been incorporated, acquires the desired salve-like consistence.]

ON A NEW PRINCIPLE OF CONSTRUCTION FOR SUSPENSION-BRIDGES AND LANDING PIERS.

[Being the substance of a paper read by Mr. H. H. Russell, at the Society of Arts, Nov. 14, 1849.]

The paper commences with some preliminary remarks on the origin and adoption of suspension-bridges, which would appear to be of great antiquity, Humboldt and other travellers having seen them in uncivilized countries constructed of bark, reeds, and bamboo-cane, &c. slung across wide and dangerous chasms, and used for passenger-traffic. In Thibet and China they have been found sufficiently strong to enable beasts of burden, and men with loads and palanquins, to pass over in safety. The application of this mode of constructing bridges in our country was first made by Captain Samuel Brown, R.N., in what he termed his "Chain Cable Bridges," and was first suggested to him by the rope-bridge of Penipe. Bridges of this description were constructed, and others proposed, by Telford Tierney Clark, and others. The success of these bridges gave so great a stimulus, as to cause their introduction into almost every civilized country in Europe; and their partial destruction has led to various arrangements for increasing their

stability, especially with a view of arresting the undulations which may be excited in them. The principle adopted by Mr. Russell was first suggested to him by witnessing the rigidity of two lines of cobwebs crossing a street in the direction of the main-chains of the bridge; a third, running in a nearly horizontal direction underneath, was supported at intervals from the upper two in the one spandril, and in the other had a circular web, of large dimensions, also stayed in all directions to the upper and lower webs; and a spider was observed to cross the lower cord without causing sensible deflection. The model and drawings exhibited were of a bridge with piers: the main-chains are arranged so as to pass over the top and under the bottom of the outer piers, thus presenting two systems of chains, having their extremities fastened at different points. By this arrangement the structure will, it is conceived, be more rigid, and the disturbance to which the bridge is subject less felt.

The disturbances to which chain bridges are subject are of two kinds,—undulatory and oscillatory. The proposed plan prevents, it is conceived, the undulation, by relieving the summit of the piers from a great part of all strain, and throwing it upon their lower parts, where it is resisted by the roadway in the direction of the greatest strength. The oscillatory disturbances, or those from side to side, are considered to be practically annihilated by reason of the smaller curvature of the chains; and the more equal distribution of the load renders any local pressure less effective in causing disturbance; and additional facility is afforded for the introduction of stays between the chains, so as to equalise to a greater extent the tension and strength of the parts. The attachment of chains to the upper and lower points of the piers diminish, it is conceived, the tendency to general oscillation, while the alternation of long and short suspension-rods, and the steadying of the longer rods by passing between links of the lower chains, must almost entirely obviate local oscillation.

Mr. Russell is of opinion, that, by the mode suggested, a counteraction to any passing weight is obtained by the lower portion of the catenary curve being supported on the pier through which it passes. The masonry above supporting the upper chain, acts so as to prevent deflection of the upper chain, unless the lower chain or pier should ascend, which is impossible, for the weight upon the suspension-rods is applied to both piers, thereby affording rigidity against action upwards.

THE APPLICATION OF THE DISC ENGINE TO MARINE PURPOSES.

The Government screw steamer, *Minx*, has been fitted by Messrs. Bryan and Dorkin with a disc engine of 10 horses power, on the same plan as that which is employed with so much success at the office of the *Times*; from which journal we take the following account of an experimental trial made with her on Wednesday last at the measured distance in Long Reach:—

"On the average of two runs down and two up, the speed produced by the disc engine was ascertained to be 5·148 knots per hour, the mean pressure of steam being 53·5 lb. on the square inch, and the number of revolutions 164 per minute. The engine has accomplished wonders, considering that it is only of 10 horses power, occupying 5 feet 2 ins. by 3 feet, and fitted to a vessel of 301 tons burden, 130 feet long, and 21 feet broad, originally constructed to carry engines of 100 horses power, which did not give her any extraordinary degree of speed, even with a considerable consumption of fuel. The 10 horses power disc engine works very economically—about 18 per cent. less than any other of the same power tried with it,—an important advantage where 10 days' consumption might be extended to nearly 12 days. It has no dead points, and can be worked with the greatest ease, stopping or reversing instantaneously, and may be made to go forwards or backwards with less than half a turn. As an auxiliary, its advantages will be very great; it is compact, and not liable to get out of order, and is so easily managed. On the return of the *Minx* up the river, when at Barking Reach, she steamed up against the tide, and on being moored the engine was opened for examination, and it appeared in most admirable condition, without any symptoms of having worked on one part more than another."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 13TH OF DECEMBER, 1849.

DOUGLAS HEBSON, Liverpool, engineer. *For improvements in steam engines.* Patent dated June 7, 1849.

Mr. Hebson proposes,

1. To connect two steam engines, each having a single crank, and its steam cylinder inclined at an angle greater or less than 45°, by means of a drag-link, or other suitable apparatus, so that one piston may be at the beginning or middle of its stroke when the other has reached the end of its stroke.

2. He substitutes for the ordinary packing and gland of the trunions of oscillating engines a packing of hemp or flax between the end of the trunion and the shoulder of the steam pipe, and which is retained there by means of a metal hoop.

3. In order to facilitate the connection and disconnection of marine steam engines, he employs a hollow crank-pin, within which slides another crank-pin that takes into a plate on the end of the shaft, which forms the other side of the crank, whereby the connection is effected. To withdraw the pin from the plate, and, consequently, disconnect the engines, a toothed wheel is used, turning loosely on the crank-shaft, and gearing into another toothed wheel keyed on the end of the inside crank-pin. These

wheels are made to revolve by a spur wheel keyed on a moveable axis, so that it may be slidden in or out of gear with the first toothed wheel, as occasion may require. When it is in gear, and rotary motion is communicated by a thumb-piece on the end of the axle of the spur wheel, the inside crank-pin will be withdrawn from the plate.

Claim.—1. Connecting two steam engines, each having a single crank, and its cylinder inclined at an angle greater or less than 45° by a drag link or other suitable means.

2. The substitution of an exterior packing for the ordinary internal packing and gland in the trunions of oscillating steam-engines.

3. The application of a hollow crank-pin, containing another crank-pin, in combination with a plate and toothed gearing, to facilitate the connection and disconnection of marine steam engines.

JAMES STEEL, Horton, York; and BENJAMIN EMMERSON, of the same place, overlooker. *For improvements in power looms.* Patent dated June 7, 1849.

The object of this invention is to wholly, or partially, remove the swell from the shuttle-box, so that when the picker acts, it may require less effort to throw the shuttle, and when the shuttle boxes, facilitate its entry, and, at the same time, allow the stop rod to act in the ordinary manner when the shuttle remains in the shed or misses boxing. For this purpose a projection is attached to a portion of the side of the fly-wheel, which, in its revolution, comes against one end of a lever, keyed on an axis, the other end of which acts upon the swell, so as to wholly or partially remove it from the box, as may be required; while the finger of the stop-rod rests upon a bearing, in order that, when the projection has passed, it may come into operation before the beat-up is completed.

Claim.—The application of an apparatus to a power loom, for effecting the entire or partial withdrawal of the swell from the shuttle-box, without interfering with the action of the stop-rod when the shuttle misses boxing.

EDWARD JOHN PAYNE, Chancery-lane, London. *For improvements in marine vessels, in apparatus for the preservation of human life, and moulding joining and finishing hollow and solid figures, composed wholly or in part of a certain gum or combinations of certain gums; also for improvements in dissolving the aforesaid gums, and in apparatus or machinery to be used for the purposes above mentioned.* Patent dated June 7, 1849.

The "improvements in marine vessels, and in apparatus for preserving human life," which form the first head of this multifarious and incongruous title, resolve themselves simply into the construction of a life-boat composed of metal tubes or ribs covered with gutta percha,—a thing achieved long before the date of this patent.

The "improvements in moulding, joining, and finishing solid figures," fade away in the specification into a receipt for making gutta percha dolls! "You are to make the doll hollow, and in halves, and then to cement the two halves together, after which you must smooth the ridges left at the junctures with an Italian iron!"

The branch of the specification which relates to "gums," contains a number of feasible-enough book receipts, but what the "improvements" consist in, is not stated.

A Waterproof Varnish.—Mix together 1 lb. gutta percha, 3 oz. gum opal, ½ lb. linseed oil, 8 oz. sugar of lead, 2 lbs. spirits of turpentine. Place the mixture in a tincture press, the cylinder of which is heated by a sand bath, and the produce is the varnish required.

A Varnish with which Colours may be Mixed, and very Suitable for Coating Articles in Gutta Percha.—Take 100 lbs. gutta percha, 18 lbs. 12 oz. gum opal, 50 lbs. linseed oil, 200 lbs. spirits of turpentine, and mix the whole together.

A Varnish for Unpainted Articles in Rough Wood.—50 lbs. India-rubber, 100 lbs. gutta percha, 30 lbs. gum opal, 70 lbs. gum damar, 150 lbs. linseed oil, 75 lbs. sugar of lead, 500 lbs. spirits of turpentine.

A Varnish for Articles of Metal.—100 lbs. gutta percha, 25 lbs. gum opal, 75 lbs. linseed oil, 25 lbs. sugar of lead, 200 lbs. spirits of turpentine.

A Varnish for Brick and Stone.—100 lbs. India-rubber, 200 lbs. gutta percha, 112½ lbs. gum opal, 235 lbs. linseed oil, 62½ lbs. sugar of lead, 600 lbs. spirits of turpentine.

A cement is produced by mixing 1 part of a composition consisting of 100 lbs. India-rubber, 100 lbs. gutta percha, 100 lbs. linseed oil, 200 lbs. spirits of turpentine, with three parts of some calcinated absorbing oxide of metal (white or red lead.)

Claims.—1. The mode of constructing life-boats or vessels, as described.

2. The treating, dissolving, and combining of gutta percha, as described.

3. The use of gutta percha, India-rubber, gum copal, gum damar, shellac, pitch, tar, resin, sugar of lead, white and red lead, and alum, in the manufacture of waterproofing varnishes and compounds, as described.

STANHOPE BAYNES SMITH, Birmingham, electro-plater and guilder. *For improvements in depositing metals and in obtaining motive power, part of which improvements are applicable to certain other similar useful purposes.* Patent dated June 7, 1849

The patentee describes and claims,

1. The dissolving of salts of silver in hydrocyanide of potassium, calcium, ammonia, barium, strontium, aluminum, or magnesium, to produce solutions for plating, either with or without the employment of electric currents.

2. The use of sileniuret of calcium, iodine, iodide of nitrogen, gun cotton or xyloidine, sulphur salts, sulphuretted oils, creosote, xanthates, bi-sulpho-carbonate of the oxide of mythele: acetic, hydrochloric chloroacetic, hydrocyanic, hydrosulphocyanic, hydrosulphuric silenious, sulphurous sulphovinic, tartaric, and xanthic acids; added to solutions of salts of silver to produce bright silvering.

3. Manufacturing articles by the electric deposition of metals on the exterior and interior surfaces of the same mould [using for that purpose a mould composed of some material such as gutta percha, which is fusible at a lower temperature than the metals, so that it may be melted and run out from between them.]

4. The use of gutta percha, to make the moulds for manufacturing articles by electrical deposition; also the employment of solutions of gutta percha to stop out portions of conducting surfaces, as may be required.

5. The use of hydrogen, evolved from voltaic batteries, as a motive power, the same being mixed and detonated by oxygen and atmospheric air.

6. The use of solutions of gutta percha, to form the etching ground, when such etching is effected by electricity or acids.

Gustave Francois Picault, Rue Dauphin, Paris. *For improvements in apparatus for opening oysters.* Patent dated June 7, 1849.

This is a simple and really ingenious contrivance for dispensing with the use of the clumsy and dangerous oyster knife. It consists of an apparatus somewhat resembling an ordinary pair of sugar nippers, but pivoted together at the top of the curved parts instead of the bottom. One of the curved parts is made hollow, or indented to receive the front edge of the oyster, which is placed therein with the flat shell uppermost, while the other part is fitted with a curved knife, which, when the handles are brought together, enters the hinge of the shells, and, separating them, cuts the oyster from the flat shell, which then falls into the deep one. One of the sides may be made a fixture, supported on standards, if deemed necessary.

Claim.—The mode of combining parts into an apparatus for opening oysters.

John Houston, Nelson-square, surgeon. *For improvements in obtaining motive power when steam and air are used.* Patent dated June 7, 1849.

This invention consists in forcing air, at a pressure equal to that of steam in a boiler, through pipes placed in the boiler into a chamber, where it mingles with the steam. The air and steam thus combined are led to a cylinder, and applied to work an engine similar in construction to that of an ordinary steam engine.

Claim.—The mode of combining machinery for obtaining motive power when air and steam are used.

Bennet Alfred Burton, John's-place, Southwark, engineer. *For certain improvements in the manufacture of pipes, tiles, bricks, stairs, copings, and other like or similar articles, from plastic materials; also improvements in machinery to be employed therein.* Patent dated June 7, 1849.

The patentee describes and claims,

1. The application of rollers turned into a suitable shape, and applied to the compression and consolidation of articles composed of plastic materials employed in building and draining.

2. Making the bends of pipes or bent pipes by placing the centre of the die eccentrically to the hole of the bed plate.

3. An arrangement of the parts of a machine for compressing the materials separately.

4. A machine for cutting a rabbet and socket joint on the ends of pipes, and also for cutting rabbets on the ends of bricks and tiles.

Charles James Anthony, Pittsburgh, America, machinist. *For certain new and useful improvements in the means of treating unctuous animal matter.* Patent dated June 7, 1849.

This invention has for its object to produce larger quantities of butter in a shorter period of time than has hitherto been practicable from like quantities of milk; and this is done by introducing more atmospheric air at each stroke or revolution of the dasher than before. For this purpose there are several cavities constructed in the surface of the dasher, which fill with, and carry down into the milk the necessary quantity of oxygen to oxidize it, in considerably less time than could be done with the ordinary flat-surfaced dasher.

Claim.—The introduction of cavities into the surfaces of the dashers, wings, or beaters of a churn, whether large or small, and whether the motion communicated to them is horizontal, vertical, or rotary; and whether such cavities are constructed in the back or front surfaces.

John Edward Payne, Great Queen-street, Middlesex, coach-lace manufacturer;

and HENRY WILLIAM CURRIE, engineer. *For improvements in the manufacture of coach lace and other similar looped or cut pile fabrics.* Patent dated June 7, 1849.

The patentees describe and claim,

1. The employment of pliers, which are actuated so as to cause them to seize hold of terry wires, place them in the shed in the proper position for being woven in the fabric, and then release them; afterwards to again take hold of them, and replace them in the shed.

2. An improved construction of batten and sley.

3. Dividing the pile of a double woven fabric by passing a knife, running in grooves, between them.

4. An improved construction of loom by which the workman is enabled to see if the working parts act properly.

WILLIAM PREDDY, Taunton, Somerset, watchmaker. *For improvements in watch-keys and other instruments for winding up watches and other time-keepers.* Patent dated June 12, 1849.

Claim.—Closing the pipes of watch-keys and other instruments for winding up watches and other time-keepers when out of use by means of sliding squares, or pistons, shields, and stoppers.

[A most ingenious machine, the details of which we shall give in our next.]

JOSEPH SAMUDA, Parliament-street, Westminster, gentleman. *For improvements in obtaining motive power, and the machinery or apparatus employed therein, which machinery or apparatus may be used for raising liquids.* Patent dated June 9, 1849.

Claims.—1. The employment, for the purpose of obtaining motive power, of a pump of a peculiar description, of which we shall give a full description in an early Number.

2. The employment, for the purpose of obtaining motive power, of several auxiliary contrivances, which are numerous; and illustrated by drawings, and very circumstantially described.

3. The pump aforesaid in the peculiar arrangement and construction of the parts of which the same consists to whatever uses the same may be applied, and particularly its use as a means of raising liquids.

4. The application of a peculiar form of piston used in the said pump to other pumps and engines.

HENRY KNIGHT, Birmingham, merchant. *For certain improvements in apparatus for printing, pressing, and perforating.* Patent dated June 7, 1849.

The patentee describes and claims,

1. A peculiar construction of press for printing letters or characters alternately or repeatedly.

2. An additional apparatus applied to the press, for effecting the combined processes of printing, colouring, and embossing.

3. A peculiar construction of lever press for the same purpose; also,

4. A peculiar construction of rack press.

5. The use of differential pulleys for communicating motion by the foot.

6. A mode of constructing an apparatus for shaping and stamping the covers of notes, letters, &c.

7. Placing the bolt and case in lever, rack, or screw presses, at a convenient distance in front or at the side of it.

ROBERT WILSON, Low Moor Iron-works, Bradford, York, engineer. *For certain improvements in steam engines and boilers, and methods of preventing accidents in working the same* Patent dated June 7, 1849.

Claims.—1. A method of constructing and arranging the boilers of steam engines, in order that when the steam exceeds a certain amount of pressure, the water shall be projected on the fuel in the fire-box or furnace, and wholly or partially extinguish it, and thereby diminish the chance of explosion.

2. A method of constructing steam boilers so that when the water descends beneath a determinate level the steam shall be driven into the fuel, which will consequently be considerably damped or extinguished, and thereby prevent the under plates from burning.

3. The use of adjustable wedges, placed between and behind the packing rings of steam engine pistons.

4. A mode of constructing the segments of packing rings of pistons, buckets, &c., with bevelled or inclined surfaces, whereby the exterior is always kept in contact with the interior surface of the cylinder.

5. A steam engine governor, to which two motions are imparted—the one being destined for the regulator or throttle valve, and the other for the expansion valve.

6. The use of a piston to give one motion to the valve, the other being given by the movement of the engine, or by a beam.

7. An arrangement and construction of valve-gearing for giving a slow and quick motion, at certain parts of its stroke, to the expansion valve.

8. An arrangement, and construction of valve gearing which, when the eccentric rod is thrown out of action, closes the valve and stops the engine.

THOMAS MASTERS, Regent-street. *For certain improvements in the construction and arrangement of apparatus for cooking, heating, and evaporating fluids, and*

obtaining decoctions and infusions from certain vegetable and animal matters; parts of which improvements are applicable to chemical processes. Patent dated June 7, 1849.

Mr. Masters describes and claims,

1. The constructing of cooking utensils with two perforated trays, ascending steam pipes, and water spaces.

2. Lining the inside of cooking utensils with porcelain or earthenware, and the use of an interior vessel of earthenware.

3. An indicator, for showing the temperature of the contents of the utensils.

4. A mode of collecting the condensed water.

5. A peculiar construction of evaporating apparatus.

6. An improved biscuit pan.

7. Lining coffee-pots with porcelain, or other vitrified substance.

8. Constructing coffee-pots with an interior vessel of porcelain, &c., to contain the infusion, in combination with water spaces.

9. A method of constructing tea-urns, in which the infusion is filtered in its upward motion, and heated by a spiral coil placed in the lower part.

10. A peculiar construction of feet-warmers.

JOSEPH WADE DENISON, New York, gentleman. *For improvements in engines for raising or forcing liquids.* (A communication.) Patent dated June 12, 1849.

Claims.—1. Forming the suction and delivery valves of pumps in a seat or surface, which is neither within or inclosed by the cylinder.

2. Covering the section and delivery valves of a pump with a cap or chamber.

3. Making the suction and delivery valves of a pump, and the joint of the cap or chamber, in one sheet of leather, or other suitable flexible material.

4. Arranging the cap so as to serve as an air chamber for the suction pipe, or to the delivery pipe, or to both.

WILLIAM HENRY RITCHIE, Brixton, gentleman. *For improvements in fire-arms.* (A communication.) Patent dated June 7, 1849.

1. To secure a continuous supply of percussion caps to the nipple, this patentee makes use of a rack, actuated by the movement of the hammer, which communicates a partial rotary movement to the nipple, and brings it opposite the reservoir of caps, at the same time unclosing it, to allow the spiral spring behind the last cap to push forward the whole series, and thereby thrust the first one on to the nipple.

2. The explosion of a cartridge is proposed to be effected by a cap attached to it, which has the detonating powder upon the sides instead of the top, and fits upon a nipple projecting from the plug into the gun-barrel, into which the hammer enters, and, striking, explodes the cap.

3. Several arrangements of springs for gun-locks are next described, but would scarcely be rendered intelligible without illustrative engravings.

No claims are made.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Dec. 7	2108	John Smith	Uxbridge	The Royal Albert cultivator.
,,	2109	Henry and John Gardner	Strand	Improved magic stove.
,,	2110	William Woodward	Minories	Concave whelp for ships' windlasses and capstans.
8	2111	Thomas Kitson Potter	Huddersfield	The Victoria spirit lamp.
,,	2112	Edward Wallace Elmslie	Gloucester-road, Hyde-park	Ventilating sash-bar adapted to all kinds of windows.
,,	2113	Battersby, Telford and Co.	Waterloo Foundry, Liverpool	Self-revolving sheave.
10	2114	John Grant	Hyde Park-street	The cottager's stove.
,,	2115	Mary Harvey	Cornhill, Dorchester	The Neapolitan stove.
,,	2116	John Sheringham	Kensington	Ventilator.
,,	2117	James Keithley	Bradford, Yorkshire	"T"-shaped boiler for heating buildings, &c.
11	2112	Thomas Moxon	Leicester	Cheese Bandage.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Jonah Davies and George Davies, of the Albion Iron Foundry, Tipton, Staffordshire, engineers and ironfounders, for improvements in engines worked by steam, air, water, and other fluids, and whether locomotive, marine, or stationary, and also in boilers, the principle of which improvements is likewise applicable to blowing air and pumping water. December 10; six months.

Jean Baptiste Ecarnot, of France, for improvements in the manufacture of sulphuric, sulphurous, acetic, and oxalic acids, and nitrates.—December 10; six months.

David Christie, of No. 3, Saint John's-place, Salford, Lancaster, merchant, for improvements in machinery for preparing, assorting, straightening, teasing, tearing, doubling, twisting, braiding and

weaving cotton wool, and other fibrous substances. (Being a communication.) December 10; six months.

Thomas Grimsley, of Oxford, sculptor, for improvements in the manufacture of bricks and tiles. December 10; six months.

John Houghton Christie, of 13, Craven-street, Strand, Middlesex, Esq., for an improved construction of wrought iron wheels, and machinery for effecting the same. (Being a communication.) December 10; six months.

The Baron Louis Lo Presti, of Paris, France, for improvements in hydraulic presses, which are in whole or in part applicable to pumps and other like machines. December 10; six months.

William Holt, of Preston-place, Bradford, York, organ-builder, for certain improvements in the construction of the pallets or valves of organ sound boards or wind chests, the same being applicable to seraphines, eolophons, harmonicums, harmoniums, and all other musical instruments in which the tone is produced by the admission of wind supplied by bellows or other machinery to pipes, reeds, or springs, and played upon by a key-board or key-boards, and also to various other purposes connected with all the above-named musical instruments. December 10; six months.

William Birkmyre, of Fulbeck-cottage, Hampstead, chemist, for improvements in the manufacture and refining of sugar. December 12; six months.

John Henry Jenkinson, of Salford, Lancaster, machine maker, and Thomas Priestley, of Shuttleworth, in the same county, manager, for certain improvements in machinery or apparatus to be used for preparing, spinning, and doubling cotton, wool, flax, and similar fibrous materials. December 12; six months.

Advertisements.

CONTENTS OF THIS NUMBER.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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Edited by J. C. Robertson, 166, Fleet-street.

HENSON'S RAILWAY CARRIAGE IMPROVEMENTS.

Fig. 2d.

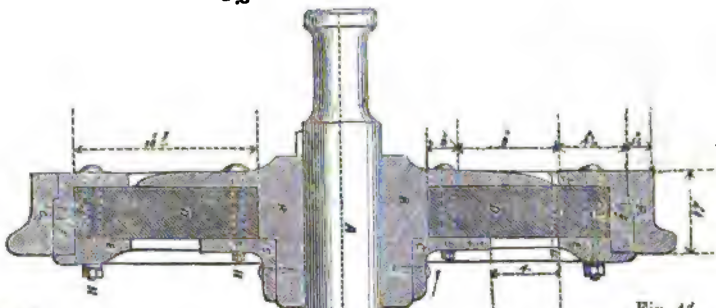


Fig. 3d.

Fig. 4d.

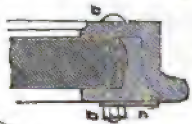


Fig. 1d.

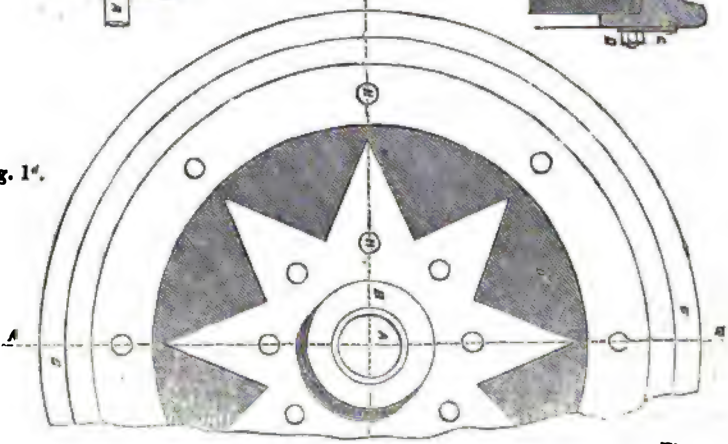


Fig. 20d.

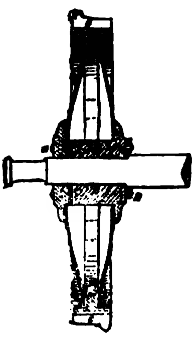


Fig. 21d.

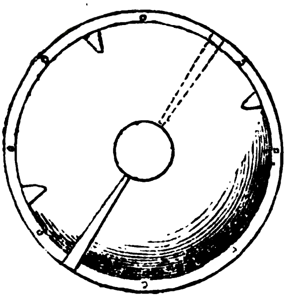
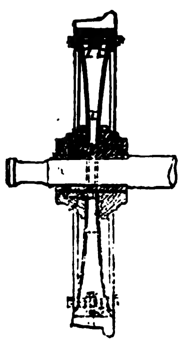


Fig. 24d.



HENSON'S RAILWAY-CARRIAGE IMPROVEMENTS.

(Patent dated June 14, 1849. Specification enrolled December 14, 1849.)

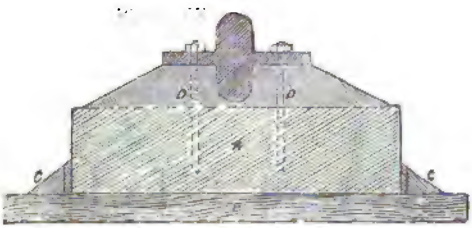


Fig. 3.

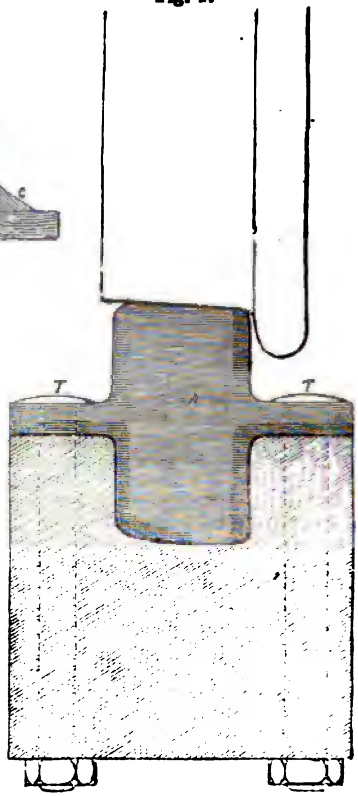


Fig. 1.

Fig. 2.

Mr. Henson, to whom the railway public are indebted for the very improved description of covered goods' wagons, which was first adopted on the North Western Railway, and is now fast coming into universal use, is the author of another large budget of improvements touching his particular sphere of employment, which we have now to bring under the notice of our readers. It includes,

1st. A new form of rail, of remarkable strength and durability; the construction of which will be readily understood by reference to figs. 1, 2, and 3.

2nd. Several forms of axles, having for their common object to diminish the frequency of fractures, by strengthening them at the bosses, where such fractures commonly occurs.

3rd. A method of largely increasing the capacity of goods' wagons without adding to their height, or increasing the amount of the superficies which they present to the resistance of the atmosphere.

4th. Some improvements in the covered wagons of Mr. Henson, before adverted to.

5th. Some improvements in the body-part of railway passenger carriages—consisting chiefly in the employment therein of gutta percha and corrugated plates of iron.

6th. Several new descriptions of wheels.

7th. A new buffer system.

We quote the descriptive details given in the specification of the improvements in wheels; and may, in a future Number, make some further extracts:

Fig. 1^d, is a side elevation; and fig. 2^d, a section on the line, AB, of a wheel, in constructing which the object has been to make it as resilient as may be consistent with the required strength. A, is part of the axle; B, is a cast iron nave, which is expanded radially in the form of a star; G, is the outer tyre; F, an inner tyre; D, a space between the inner tyre and the centre part of the boss, which is filled up with a solid ring of some elastic substance, as vulcanised caoutchouc, cork, or asphalted felt, or papier maché, kamptulicon, &c. C and E are two rings which, with the help of the bolts and nuts, HH, connect the boss, the solid ring, the radii, and the inner tyre all firmly together. Wheels of this sort will be found to possess a high degree of elasticity, and will be attended with less tear and wear, both to the carriages and to the rails than the ordinary rigid wheels.

Fig. 3^d, shows a modification of the preceding mode of construction, in which the ring, E, is dispensed with. The inner tyre is in this case turned over so as to clip the packing (instead of the ring) and the inner and outer tyres are united together as well as with the solid elastic ring by an external coupling plate, C, and bolts and nuts, DD.

Fig. 4^d, is an elevation, partly in section, of another elastic wheel, in which the elastic packing is entirely incased within the wheel. A, is the axle; B, the boss, which is cast in one piece with the flange, C; D, is an annular disc, which incloses the side of the wheel opposite to C. The outer tyre of the wheel is composed of nearly the same parts as the wheel represented in fig. 1^d, and before described. E and F are two rings of vulcanised India rubber, or other elastic compound, one surrounding the boss and the other pressed out against the tyre of the wheel by a ring, G, of wood, which is interposed between the two elastic rings, E and F.

Fig. 20^d, is a cross section of another wheel, the sides of which are composed of two convex metal plates, connected together under a considerable degree of tension. A, is the axle; B, the boss, which is made in two parts, 1 and 2, in order that by the temporary removal of the former, the plates may be inserted in their places. C, is an inner tyre, with a projecting ridge, R, to which the edges of the plates are firmly bolted; D D, are bolts and nuts, by which, after the plates have been put in their proper positions, and the part 1 of the boss restored to its place, the two parts of the boss (with packings of India-rubber inserted between them), and the side plates are screwed up to any degree of tightness which may be thought desirable. Each plate has an aperture in the centre for the boss and axle, and has a cut made in it from the periphery up to that central aperture, in order to allow of the necessary compression being given to the plate. But the cuts are made in opposite directions, that is to say, the cut in one plate runs in an opposite direction to the cut in the other, as exemplified in the side elevation, fig. 21^d. Fig. 22^d is a side elevation of a wheel of this description in its complete state, and fig. 23^d, a cross section of a single disc. Fig. 24^d shows another wheel, in which, as in the preceding case, the sides are composed of solid metal plates, but of a concave form; and it shows also a modification necessary to be made in the form of the inner tyre, in order to suit the difference in the bend of the plate, which are bedded upon pieces of lead, L L. The boss in this case is divided into two parts, as in the wheel last described; but they are also proposed to be brought together, with the centres of the side plates between them, by making the one screw into the other.

PHILLIP'S FIRE ANNIHILATOR.

Sir,—As I had the pleasure, a few days ago, of seeing Phillip's Fire Annihilator experimented with, some thoughts have occurred to me as to its advantages and disadvantages in extinguishing fires, which, if you consider of any value, I shall be glad to have inserted in your valuable Magazine.

The experiment was made upon timber and shavings sprinkled with turpentine and tar. When the mass was ignited it produced a large flame, and on applying the gaseous vapour from the machine, the flame expired almost instantaneously, but the red heat or burning embers were not extinguished. In fact, the vapour had little, if any effect upon them, and Mr. Phillips stated that his object was to put out the flame, which was *the* fire, and that the red heat was merely its accompaniment.

Now it appears to me, that this red heat is the cause of the flame, and that, as soon as a draught of air reaches it, the flame is the result. Suppose a warehouse to be on fire, and the vapour of the annihilator used; if the air can be so thoroughly impregnated by it (which I doubt), the flames will go out, but the red heat will still be left unaffected by it, and, consequently, the warehouse will have to be kept filled with this vapour

till the bales of goods have burnt themselves out, which would not be the case for days, and perhaps weeks; or—what would be more likely—till the red heat (which, in a fire of this description, is immense) had so weakened the walls as to cause the whole building to tumble in.

It therefore seems to me, that we must not trust to the fire annihilator for extinguishing warehouses, or any building where much red heat is likely to be generated; for if we do, as soon as the vapour is expended or rises in the atmosphere, the oxygen of the air will unite with the gases given off from the smouldering, but burning embers, and the whole will burst into a flame again.

The fire annihilator will also be of little avail, if any, in preventing the spread of the fire from roof to roof; for when the water is applied from the common fire-engines, the materials become saturated and damp, and, if need be, the water can be continually thrown; for generally at London, the water increases the longer the fire lasts, for the turncocks open or shut the different mains as they see necessary to increase the pressure round the fire; but the effect of the annihilator is very different—it will only put out the actual flame, and not the burning flakes; and as the flames may last for several minutes, or perhaps an hour or two, according to the fierceness of the fire and the difficulty which there might be of reaching the mass actually on fire from below, the vapour would have to be applied continually all this time, and at a great expense, one cake of the composition costing five shillings, and lasting only about three or four minutes; besides which, there is the loss occasioned by the wind (the gravity of this gas being about the same as the atmosphere), which might, if blowing fresh, be considerable.

The utility of the machine seems to me to consist in its first and immediate application before red heat is generated to any great extent. In many cases it will be very useful where, from the position of the goods on fire, a bucket of water could not reach them—as, for instance, in drying stoves, printers' store-rooms, &c., where the goods are suspended from the roofs and ceilings. It will also be exceedingly serviceable in distilleries of all kinds, because water acts upon their inflammable contents with no good result, but rather increases the mischief by splashing the lighted material over the building without extinguishing it. It will be useful, too, in mansions and buildings generally in the country, where engines are not available. But if the foregoing observations be correct, the machine is only fit as a private domestic preventive, and cannot possibly supersede the ordinary application of water by the common fire-engines.

I am, Sir, yours, &c.,

RED HEAT.

London, December 13, 1849.

POSITION OF THE AIR-VESSEL IN PUMPS. WILLIAMS' TREFFOS PUMP—DENISON'S PATENT.

Sir,—The recommendation of "A London Engineer" (at page 568 of your last Number), to place an air-vessel upon the *suction-pipe* of pumps, would, if adopted realise no practical advantage. The very first action of a pump is, to exhaust the air from the suction-pipe, and all the passages communicating with it, which then become filled with water. The existence of an air-vessel under such circumstances is therefore altogether a fallacy.

The proposition of your correspondent bears a striking resemblance to the "*Treffos-pump*" of Mr. Williams, submitted to the Liverpool Meeting of the British Association in 1837, as reported in the *Mech. Mag.*, vol. xxvii., p. 447. Mr. Williams' project for placing an enlarged chamber on the suction pipes of pumps, with a view to obtain the advantages sought by "A London Engineer," were very fully discussed at the time, and an elaborate review of Mr Williams' scheme by your talented correspondent, Mr. R. Evans, appeared in your 28th volume (pages 120 and 132), a careful perusal of which I would recommend to "A London Engineer."

It is somewhat singular, that your last number (page 574) contains an abstract of a patent by Mr. J. W. Denison, of New York, in which he claims the arranging of a cap so as to form an "*air-chamber* to the *suction-pipe*,—to the delivery-pipe—or to both." The fact is, that Mr. Denison's patent is at least a century behind the age; he claims the placing of the suction and delivery-valves

on seats," neither within nor enclosed by the cylinder, also the covering of the valves with a cap or chamber." This arrangement, formed the subject of a patent granted to Mr. Simpkin, as far back as 1792,* at which time it was considered an original invention. The principle of separate and readily-accessible valve-chambers in hydraulic engines, has been extensively and variously applied since the date of Simpkin's patent; one illustration may be seen in Merryweather's patent fire engines; another excellent application of Simpkin's plans may be seen in the Farmer's fire-engine (*Mech. Mag.* vol. xlvii., p, 299), where the valve-chamber is quite clear of all the other parts of the machine. Mr. Denison's plan of making the suction and delivery valves of a pump, and the joint of the cap or chamber in one piece of leather, &c., is equally antique, and almost entirely superseded by the general preference now given to metallic valves, in all good pumps.

On reference to your 9th vol., p. 155, it will be seen that the plan of *separate valve chambers* had been used before Simpkin's time—such an arrangement having been employed by Peter Morris in the erection of the first waterworks at London Bridge, in 1582, as was shown by the discovery of their ruins while digging the foundation of the New London Bridge, in 1828.

I remain, Sir, yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington, Dec. 17, 1849.

* *Vide* "Engineers and Mechanics' Cyclopædia," vol. i., p. 509; also *Mech. Mag.*, vol. xxvii., p. 324.

LLOYD'S AIR-EXHAUSTING MACHINE.

Sir,—In your Magazine of the 24th of November last, you noticed a pamphlet by Mr. Brunton, giving a description of a ventilator for coal mines, which, as you very justly remarked, does not materially differ from mine. In the following number Mr. Bessemer describes a machine made by him for the same purpose, and which there can be no doubt is precisely the same in principle as the other. Now the three being identically the same, it only remains to show who is the real inventor, and I trust shall be able to do so in a few words. Mr. Bessemer's machine, according to his own statement, was erected in June last, and Mr. Burton's about the same time, while mine was patented in March, 1848; and a description with engravings was given in your publication of the 16th of September following, and likewise in the *Mining Journal* and other publications soon after—being nine or ten months before the production of either Mr. Brunton's or Mr. Bessemer's machines. The latter gentleman indeed states that he patented his machine about five years ago: it is true, that he did patent a machine to be applied to the same purposes about that time; but if I can understand his drawings and specification (and I must give them credit for perspicuity), it is very different to the one represented in your Journal, and consequently to mine. In fact, they do not resemble each other at all, except in such parts as are old, and which of course belong to neither of us.

That the machine described by Mr. Bessemer will accomplish all that he states is perfectly true,—this I have long since proved by experiments of my own; but then, this is wholly attributable to that particular construction of the fan which I claim as exclusively my own.

I remain, Sir, yours respectfully,

GEORGE LLOYD.

70, Great Guildford-street, Southwark,
December 20, 1849.

ON DR. PELL'S GEOMETRICAL THEOREM.

Sir,—In my notice of the Mathematical Periodical entitled the *British Oracle*, pages 562, 3, of the last volume of the *Mechanics' Magazine*, a short account was given of a collection of *fifteen* different geometrical solutions of "Dr. Pell's famous Geometrical Theorem." Since that time an old folio has fallen in my way containing the "Miscellanies or, Mathematical Lucubrations, of Mr. Samuel Foster, sometime publike Professor of Astronomie in Gresham Colledge in London. Published, and many of them translated into *English*, by the care and industry of John Twysden, C. L. M. D. Whereunto he hath annexed some things of his own. London, 1659." Amongst the additions by Dr. Twysden, are "certain Mathematical Problems (concerning Triangles as well Oblique as Rectangled), Analytically Resolved and Effected:" and as the fifth of these con-

tains a solution of Dr. Pell's Theorem, and, moreover, is of some importance in a historical point of view, I have been induced to transcribe it for publication in your Journal, and shall feel much gratified if you consider it worthy of insertion in an early Number.

I remain, Sir, yours respectfully,

THOMAS WILKINSON.

Burnley, Lancashire, December 14, 1849.

"*Problem V.*"

"In the year 1644, Mr. John Pell, Professor of Mathematics in Amsterdam, caused a certain paper to be printed, and dispersed abroad, containing a theorem, by help of which he hath both solidly, and substantially confuted *Longomontanus's* Book of the absolute measure of a circle, as may appear more largely in a Book since published by Mr. Pell against *Longomontanus*. One of those first papers, Sir William Beecher, then living at Rouen, sent me to Paris, to whom I returned my answer after some days; whether it miscarried or no, I know not. The Theorem was as followeth:

"Let the tangent of any arc (less than 45°) be multiplied by double the square of the radius; from the square of the radius take the square of the tangent. Let the *first* product be divided by this residue, the quotient shall be the tangent of the double arc."

I reduce it into the form of the following problem:—In a right-angled triangle, there is given the base (r), the segment of the perpendicular conterminous to the right-angled (t), with the angle at A bisected, to find the perpendicular and the whole triangle:

"The hypothenuse $= \sqrt{(r^2+a^2)}$, by Euc. 47.1., and we have given r and t to find a.

$$r : t :: \sqrt{(r^2+a^2)} : a-t, \text{ by Eucl. 3.6.}$$

$$\therefore ar - tr = \sqrt{(t^2r^2+t^2a^2)}; \text{ hence by squaring we have}$$

$$a^2r^2 - 2r^2at + t^2r^2 = t^2r^2 + t^2a^2.$$

Whence by transposing and reducing

$$r^2 - t^2 : 2r^2 :: t : a.$$

$$\therefore a = \frac{2r^2t}{r^2-t^2}; \text{ which is the Theorem of Mr. Pell.''}$$

As the original solution is in Latin, I have taken the liberty of modernising the notation and omitting an immaterial step or two in the process, but have retained that in which the author *re-converts his equation into a proportion*, previously to determining a; the "determination" of the limitation noticed in the statement of the question, and the geometrical construction of the resulting formula are also omitted as unimportant. It may, however, be remarked, that the *transition state* of Algebraical Notation is very evident in the volume from which the preceding solution is transcribed. Thus, we find the diphthong æ *inverted*, and $=$, indifferently used as signs of equality in the same page; $\sqrt{q}$ and $\sqrt{}$ are found as signs of the square root, and though in general the power of the same quantity are written at full length, yet such expressions as $a^4 + bb\,aa + \frac{b^4}{4}$; x^4 æ $-14x^3+99x^2+1036x-5280$; $xxx - 64\,xx + 192$ æ 00; g^4+b^4 and $4\,gggg + \frac{1}{4}\,bb$ occurring within a page or two of each other, sufficiently prove that the exponential notation was gradually finding its way into mathematical publications.

MENTAL ARITHMETIC.

Mr. Crank, Mathematical-master, St. Martin's College, Chelsea, in a book of arithemetic, lately published by Parker, West Strand, p. 142, gives a rule for mentally reducing decimals of pounds to shillings, pence, and farthings, and its converse, which is the same precisely with that previously given by Professor De Morgan in the "Companion to the British Almanack, for 1841."

Of this rule Professor De Morgan says,

"Till a few years ago, this rule was the property of actuaries, to whom it saved many a tedious reduction and much risk of error.

"It has of late years been introduced into elementary works, but few know how much labour may be saved by it, for which reason we repeat it here."

Mr. Crank observes of it:

"*This rule and its converse were composed by one of my worthy instructors, T. Kemp, Esq., Buckingham-street, Fitzroy-square, whose classical, mathematical, and scientific attainments I have never yet seen surpassed.*"

Now, I cannot reconcile this statement with the following quotation from the well-known work on arithmetic (to be found on many an old-book stall) of Benjamin Donn, published in 1756. Edition 2nd, p. 342:

"*To find the value of any decimal of a pound without either tables or pen.*

"Here we only consider the first three figures after the decimal point, rejecting the others as inconsiderable in common affairs.

"We mentally multiply the figure which stands in the first place after the point, by 2, and the product will be shillings, if the figure in the second place is not 5 or greater;—but if it be 5 or greater, then 1 is to be added to the number of shillings already found, for the number of shillings required.

"Then take the excess of the figure in the second place above 5 (or the figure itself, if it be not 5,) and this figure considered as tens, together with the figure in the third place, considered as units, will express the value of the remaining part in farthings, if it be not above 24, but if it is, or exceeds 25, one farthing must be deducted."

Mr. Donn then proceeds (p. 344) to give the rule:

"*To put shillings, pence, and farthings into the decimal of a pound without either tables or pen, true to three places of decimals.*

"Rule.—Imagine a nought (0) on the right hand of the shillings, and then take the half, which, if but one figure, is 10ths; if of two figures, is 100ths, and the decimal thus found will be the value of the shillings in the decimal of a pound.

"This being done, turn the pence and farthings into farthings, and take them as 1000ths of a pound (remembering, if they amount to 24, to add 1) and the decimals collected together will be the decimal required."

Now, these rules, as given by Donn, are manifestly the same as those quoted by Professor De Morgan, and now attributed by Mr. Crank to his "worthy instructor," T. Kemp, Esq., of Buckingham-street, Fitzroy-square. If there is any difference between them, I shall be glad to have it pointed out.

JOHN MULLINS.

Battersea.

THE MOLES OF TANGIERS AND GENOA.

Sir,—With reference to a paper which appeared in your Number of the 8th instant, I beg to inclose the following extracts from a curious account, by Sir Hugh Cholmley, Bart., 1787, of the moles of Tangiers and Genoa, and which may tend to arrest the conclusions of your correspondent in favour of vertical breakwaters, and at the same time show that the advocates of the sloping system, guided by their experience, were not far wrong when they pronounced against the vertical wall system, or the hollow caisson system, as practised by Bentham at Sheerness. These extracts will also show, both in point of protection, time, and economy, the insecurity of the caisson system, and thus confirming in every respect the evidence of the able advocates of sloping breakwaters:—

Page 45 (speaking of breakwaters), Pliny says, that "The Port of Ostea was formed by casting, in a confused manner, great stones into the sea from a great ship, one upon another, where they remained firm by their own weight, so that at last its rocky back appeared above water, and received and dispersed with great noise the several seas that beat upon it."

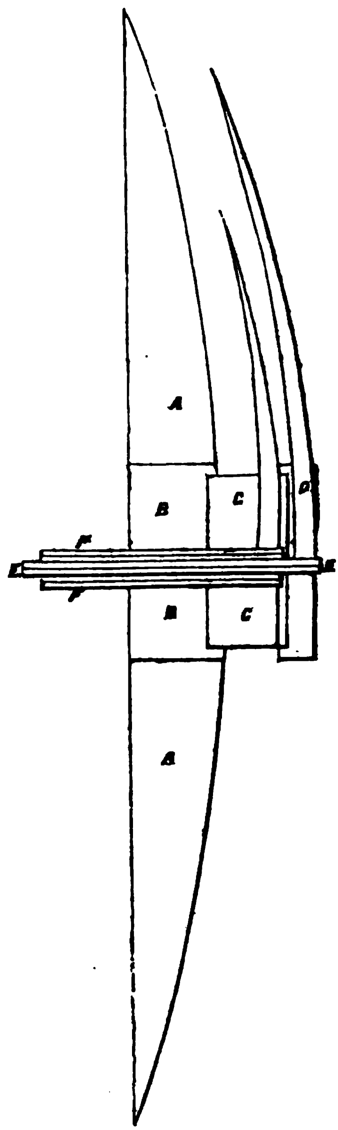
Page 49.—"It is certain that in deep water, where seas fall with great weight, no body that is contiguous can be made of sufficient strength; for the thickness of the wall is of small consideration, because the sea will first shake, then loosen the wet stones, and afterwards fetch down the upright wall little by little; and therefore at Genoa, though the wall be made of massy hard stones, and these all laid in limy tarras, so that it seems an entire rock, near twenty yards thick, yet it is found of insufficient strength, and therefore, at some distance from the mole, they have raised a ledge of great rocks to take off the first force of the sea; and this they continually feed, at considerable charge, by bringing new stone to it every year."

Page 52, Sir H. Cholmley says, "The moles in the Mediterranean were usually built by casting in stones at random into the sea until such time as the work appears above the water, and then they build upon this foundation, either with great stones loose placed, or otherwise cemented with limy tarras. At Genoa, they had an old mole built after the common practice, which afforded sufficient station for great ships, excepting only that there was at times some dangerous seas which fall in from the south-west. To prevent these, they took into consideration the making of a mole which ran from an advantageous point, distant

about a mile from the old work, and was to run from the north toward the south about six hundred yards, ere it could come perfectly to secure it. After several years expended in bare considerations of making the mole, they bethought themselves of a way that had not been used in any former practice, which was to lay the foundation of this work on chests, that is, in great cases or frames, of wood, which were to be in length the whole breadth of the mole. Then they wrought securely in summer within the protection of the harbour they had; first making the woodwork; when the same was caulked and framed, they launched it into deep water, and there secured it afloat with moorings. These chests are 54 feet in length, 36 feet in breadth, and 18 feet deep; the sides and ends, uprights and the bottoms, made flat, that they may lodge more steadily upon the foundation. Whilst the chest remains in harbour, they build within it with stones of all sizes, well wrought with lime tarras, which they fetch at easy terms from Rome or Naples, and thus they load the chest as far as it can carry to float with safety unto the place they intend to set it, which being about one-third filled, will become so deep loaded as not to be more than two feet above water. Now, because the mole is built in the depth of ten fathoms, they fill the foundation with stones, promiscuously cast into the sea, until such time as it is raised within a foot or thereabouts of the depth of the water which the chest thus loaded draws: on this foundation they plane the best they can by men, who, diving, level as well as it is necessary the stones on the bottom, and thus having fitted the plane, they tow the chests unto it, which being caulked and made tight, their masons work within it as safely as men lodge in that part of a ship which is under water.

"And this wall is raised above the water 18 feet, besides 6 feet more for the parapet, in all 24 feet perpendicular height above the sea. And yet this part of the work, which is without all question the most exposed, they cannot secure upon other terms than by raising before it another mole, composed chiefly of great rocks, from 5 to 15 tons, which they commodiously bring, because of the calmness of the season, in a kind of barge, in which is fixed a wheel and a kind of crane-engine, by the help of which they raise thus great stones. This outward mole they keep continually feeding with stone as an undoubted security to the other inward, more polished work, the defects of which they also repair as there is occasion for it. They many times have not been able to place above one chest in a year, and never above two, which makes their great advance in that space of time no more than 25 yards, and for this cause they have employed *twenty-six years* in making their mole, as it is this day 340 yards in length; and it will yet cost them half as much more time before it secures the old mole.

NEW METHOD OF ILLUMINATING CLOCK DIALS. BY MR. GEORGE WHITE.



Let AA, represent a section of the dial; BB, an opening in the centre, through which the pinions pass; CC, a collar of copper, or other material lined or polished on the inner side, and as much smaller as will permit it to turn on the short-hand shaft within the central chamber; DD, another collar of a similar material, but having also a circular front, and carried by the long-hand pinion, yet without coming into contact, or in any way interfering with the long hand; it will be seen that these form a kind of chamber, in the centre of which the indices terminate. Now, if these pointers were hollow, opaque at the back and transparent, or semi-transparent in front, it seems evident, that if the central chamber were illuminated, the light would pass into the interior of the hands, the quantity of which would be in proportion to the area of the aperture within them. By this means the position of each pointer would be apparent after dark, and would enable most persons to ascertain the time, even though the figures marking the hours were invisible.

The light could be produced by gas or other means, and its power would depend on its distance from the pointers. It should be observed, that the short hand should be composed only of *two sides* at the part within the chamber, otherwise in passing it will obstruct the light of the other.

It appears to me that such a method would render the pointers more distinctly visible, though with only a fraction of the illuminating power now employed, and might also be applied for railway and other signals.

G. W.

St. Mark's School, Jersey, Nov. 28, 1849.

EFFECTS OF WINTER ON ELECTRO-TELEGRAPHIC COMMUNICATIONS.

Sir,—The approach of winter has always been dreaded by persons having the charge of electric telegraphs. During rain and fog, the insulation becomes very defective; frost often breaks the wires, thereby rendering several of them useless, and even when the top one breaks, the whole of the communication is for a time stopped.

On the 26th, 27th, and 28th of last month, several wires broke every night on the London and North Western line of telegraph, from contraction caused by the severe frost. This might, perhaps, have been prevented, if sufficient care had been taken to slacken them out at the winding posts during the autumn. I do not know if any notice has hitherto been taken as to the time of day at which these breakages take place, but I believe they will be found in most cases to occur between five and seven in the morning,

Stoppages, however, from frost, are not so much to be feared as those from damp. When lines of telegraph were short, and only few wires were used, it was believed that rain would scarcely affect the working of the needles (see *Mech. Mag.*, vol. xlii., p. 192); but now that long lines have been erected, and several ways of communication (and consequently many wires) are required, it is found that a quill round the wire at the point of support (as on the line from Paddington to Slough), or a piece of cotton dipped in tar, are not sufficient for its insulation. Cones of earthenware, through which the wire passes, have been substituted, but not been found efficient, for whenever there is rain or fog, the motions of the needles become very weak, and generally all ways of communication but one are stopped.

Taking, for example, the southern division of the North Western Telegraph—there are on this line 7 wires; 2 of these go through Birmingham to Derby, Normanton, York, Newcastle, &c.; 2 go to Birmingham, Manchester, and Liverpool; 2 are used for the railway company's business, and pass through instruments at Camden Engine House, Tring, Wolverton, Rugby, Birmingham, Stafford, Crewe, &c.; the 7th wire is used for Bain's printing telegraph from London to Manchester. In fine dry weather, London can speak well on all the seven wires, and has, therefore, a direct communication with all the different stations; but when it is wet or foggy' even over a portion only of the lines, the communication becomes so bad, that London signals cannot reach such stations as Normanton or Manchester, and are sometimes scarcely visible at Birmingham. Also from what is technically called "contact," London cannot speak to Birmingham both on the Normanton and the Manchester lines of wires, because the current which is sent along one wire not only deflects the needle

to which it is attached, but passes also into all the other wires, and deflects more or less all other needles, and makes all kinds of *unreadable* marks on the paper of the printing telegraph. It is then necessary to take the two best wires —that is to say, those least "in contact," and put them to one instrument; the five others being for the time rendered useless.

Private messages and the ordinary expresses are then delayed by having to be first read off at Birmingham, and there repeated to other stations, instead of being sent direct; and from there being one instrument only at work, messages have to be refused, and important expresses thrown aside: therefore, as one of your correspondents remarked (vol. xlix., page 273), "Whatever tends to improve the means of transmitting signals by the aid of electricity, is likely to be beneficial to the public as well as to the Electric Telegraph Company."

Many plans have been proposed, and some tried, during the last two years, to improve the insulation, so as to remedy the evil caused by wet. The best, at first sight, would seem to be that of inclosing in tubes or troughs underground wires, covered with some material such as India-rubber or gutta percha. This is, however, a very expensive mode of insulation; the chances of the wire coming into contact with the earth are numerous; the difficulty and labour of finding out and remedying faults are great. Underground insulation is said to have succeeded in Prussia, but I believe that in England it has always been a failure.

Mr. Hammerton, the correspondent alluded to above, who was at the time one of the principal officers of the Electric Telegraph Company, proposed insulating the wires at the point of suspension on the poles by means of long gutta percha tubes instead of earthenware cones (*Mech. Mag.*, vol. xlix., p. 272). I do not think this plan was ever tried; but it is to be feared that it would not have been successful, as in the open air the sun cracks, and, as it were, *rots* the gutta percha.

India rubber was, I believe, wound round the wires inside the earthenwares, as an experiment, on the North British line, and certainly, for a time, greatly improved the insulation, but it was soon found to drop off from the action of the sun upon it, as in every other case where India rubber has been used in the open air.

Improvements have also been attempted in the shape of the earthenwares. A new kind of insulator was included in Mr. Ricardo's patent of September 4, 1848 (*Mech. Mag.*, vol. l., p. 232), but it appears that a similar one had been introduced previously in America (*Mech. Mag.*, vol. xlvii., p. 94), and one also patented in England in 1846 by Mr. Moses Poole (*Mech. Mag.*, vol. xlvii., p. 41; and vol. l., p. 244). The insulator of Mr. Ricardo's patent, which, from its shape, has been called the "bell," or "umbrella" cone, has been introduced during the last year on most of the lines of the Electric Telegraph Company, but has not improved the insulation to the extent hoped for. The difficulty from rain and fog has certainly been lessened, but still exists to so great an extent as to prevent more than one instrument working at the same time. This may be due partly to the form of the "bell cone," which is described in the specification as "having a hollow centre, closed at top by cement, in which the hook is suspended." In many cases the hook has been, from the carelessness of the workman, left projecting through the top of the mastic; the rain water which accumulates on the upper part of the earthenware makes a connection between the hook and the arm of the pole, and conducts the electricity along that arm to the next bell, and if this happens to be also defective, a contact takes place at that point. Besides if the cement or mastic is not properly mixed, it either dries into a powder, or else remains quite soft.

A better form of bell cone will, it is hoped, be adopted by the Electric Telegraph Company; certainly Mr. Poole's seems far superior to Mr. Ricardo's, and an insulator, which is also bell-shaped, has lately been invented, in which the hook locks itself inside the earthenware, and is kept in its place by the weight of the wire itself; no mastic or cement is required, and the top, being rounded off, throws off all rain water.

It has been thought hitherto that damp air and fog do not conduct the electricity from one wire to another; that is to say, that they do not of themselves, without the aid of bad insulation at the points of

support, act as a conducting medium. In short distances the effect is so slight as not to be perceptible, but in long lengths it would appear that the current does pass away to a great extent from one wire into the next through the damp atmosphere. If this be the case, the effect would be decreased by putting the wires further apart; but the most effectual remedy would be to coat the wire itself with some insulating composition. Marine glue would, I think, answer the purpose. The idea is not new; Mr. Reid patented last year (*Mech. Mag.*, vol. xlviii., p. 516,) the insulation of wires with marine glue, but in an underground arrangement only. It might be said that the sun would have an effect upon it, but it is not so. Part of the iron work at the winding posts, and about one foot of wire on each side of the post, were covered with marine glue early last year on No. 7 wire, on the London and Birmingham line, and the composition is now as fresh as when first put on.

Perhaps some of your readers can furnish some information as to what would be the cost per mile of covering the wire with this glue* (the wire used is No. 1, about one-sixth of an inch diameter); some, perhaps, can propose a better and *cheaper* material for coating the wire.

I am, Sir, yours, &c.,
THEODORE G. DE CHESNEL.

THE AMERICAN STEAM NAVY.

(From the Journal of the *Franklin Institute.*)

Within the last twenty years, the navies of England and France have undergone a great change by the introduction of steamers; and in any naval contest this country, at the onset, would suffer from the want of a suitable number of vessels of that class. By the liberal aid which the English government have extended to private companies, they have in reserve a very large number of first-class steamers at a nominal expense. Our own government are now trying, in a measure, to make up for lost time, and contracts have been made with parties, who are to build the following steamers for the routes designated, with the understanding that, in case of war, the Navy Department may take the vessels at a valuation.

4	of 2700 tons,	to run from	New York to Liverpool.
4	„ 2400 „	„	New York to New Orleans.
3	„ 800 „	„	Panama to Oregon.
3	„ 1800 „	„	New York to Bremen.

Of these vessels, there are two of the New Orleans line finished, three of the Pacific line, and two of the Bremen line; the rest are in a state of forwardness, and will probably be all done in twelve months. In addition to the above, there are thirteen sea steamers, from 500 to 1000 tons burthen, employed in private service between New York and New Orleans, at the different ports, making an aggregate of 40,000 tons, which could be at the disposal of the government when required, although several of the vessels have no mail contract.

Having spoken of the private steamers, those that the government *may have*, I propose to go on, and speak of those vessels which really belong to the navy, most of which have been built from the designs furnished by the proper departments, and may, therefore, be considered indicative of the ideas entertained at the Navy Department in relation to war steamers. This, of course, applies to those now building, and not to those already built, of which I shall speak first.

The first of the naval steamers we now have is the *Fulton*, built about twelve years since; it is much to the credit of the Department, that no person has been willing to assume the responsibility of having designed this vessel; like Japhet, she has long been in search of a father, but without any prospect of success. She is now at anchor at the Brooklyn Navy Yard, being of no service, except to be used in the harbour of New York. The Department would do well to remove the machinery, which is very good, and, with some changes, would answer for a ship of 1000 tons; as she now is, she would not be safe out of the harbour, and cannot be considered as of any account when speaking of *sea steamers*.

Our second vessel is the *Mississippi*, a fine steamer, built in 1841, about 220 feet long, 40 feet beam, and 23 feet hold, with two English marine side lever engines, of 460 horse power, and four copper boilers for bituminous coal. This vessel has been in commission about eight years, during much of which time she has been in active

* The expense of galvanising the wire woulp then be saved.

service, and has always given satisfaction. She has recently made the passage from Norfolk to Gibraltar in sixteen days, with an average consumption of 30 tons of coal in twenty-four hours. The *Missouri*, a sister ship, but with inclined engines, was burnt a few years since at Gibraltar.

Our third vessel is the *Princeton*, a propeller. This ship is about 160 feet long, 30 feet beam, and 20 feet hold; has two semi-cylinder engines, and a propeller of 14 feet diameter, three boilers of iron, and uses a fan to increase the draft, natural draft not being sufficient to supply the required heat of steam. This vessel may be considered the best of her class, and has done considerable service. She has just returned from a two years' cruise in the Mediterranean, and her hull has been condemned. She was built in 1843, of white oak, obtained in a hurry, and her rapid decay is, in a great measure, no doubt, owing to the great heat of the boilers.

Our fourth vessel is the *Alleghany*, built of iron at Pittsburg two years since. She is about 180 feet long, 32 feet beam, and 19 feet hold. She is propelled by two of Hunter's submerged wheels, of 14 feet diameter, and 4 feet face, with engines of 60 inches diameter of cylinders, and 4 feet stroke; usual number of revolutions, 30; two boilers for bituminous coal, with natural draft. The model of this ship is peculiar to this mode of propelling, being cut away under the water line, so as to allow the paddles to project. This vessel has been in service about two years, most of the time at Brazil and the Mediterranean, from whence she recently returned. Her speed at sea is not more than six miles per hour, and she is probably the last of her class, as this mode of propelling has nothing to recommend it to favour.

Our next vessels are the *Massachusetts* and *Edith*, propellers, both now in the Pacific. These vessels were bought from private service during the Mexican war, and were transferred to the Navy Department at its close. They are about 500 and 700 tons, with a speed of from six to seven miles per hour, and would most likely be used as transports.

The *Water Witch* comes next, a small iron steamer, with side wheels. She was originally built with Hunter's wheel, but condemned, then lengthened, and Loper's propeller put in; she then made the passage from Philadelphia to Norfolk, was then again condemned, and condensing engine and side wheels put in. She is now considered a fair vessel of about 250 tons.

The last we have is the *Vixen*, a small vessel 118 feet long, 22 feet beam, and 8 feet hold, originally built for the Mexican Government; engine with 30-inch cylinder, 6 feet stroke; speed 8 miles per hour. This and the *Spitfire*, a sister vessel, were constantly employed, during the Mexican War, on the coast of Mexico, where their light draft of water rendered them invaluable.

These are all the vessels at present belonging to the Navy that are finished, and can be brought into use on our seaboard.

X.

PREDDY'S PATENT WATCH-KEYS.

(Patent dated June 12, 1849. Patentee, William Preddy, of Taunton, watchmaker. Specification enrolled December 12, 1849.)

One of the most frequent sources of the bad going of watches and clocks, but one which, strange to say, has been hitherto entirely overlooked, is the introduction of dirt and damp into the works by means of the pipes of the keys used for winding them up.

A very ingenious and most effectual remedy for this evil has been at length devised, and forms the subject of the present patent. Mr. Preddy's keys are so constructed that neither dirt nor damp can possibly get into the pipes of the keys, nor consequently, into the watches or clocks. He describes no less than six different modes of construction by which this may be accomplished. We extract the following details from Mr. Preddy's specification:—

In fig. 1, which is a longitudinal section of a watch-key through the centre of it, A represents the bow or loop, which is connected by a hollow neck, *a*, to the open body piece, B; C, is a rod, which, commencing at the head of the body piece, B, extends into the pipe, P, and reaches to the end thereof, where it terminates in a sliding square or piston, D, which exactly fits the aperture of the pipe; and E is a spiral spring, which is coiled round the back end of the rod, and abuts against a stop, F, affixed to the middle of the piston rod. As long as the key is out of the watch, the spring, E, keeps the sliding square or piston pressed out to the end of the pipe, P, and thereby prevents any lodgment therein of damp, dust, or dirt, while, on the key being introduced into the watch for the purpose of winding it up, the winding square to which it is fitted presses the sliding square or piston back, to be again restored to its place the moment the key is withdrawn, the extreme end of the piston rod receding into the neck, *a*, in proportion as the square or piston is pressed back.

Fig. 1.

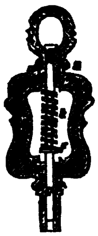


Fig. 3.

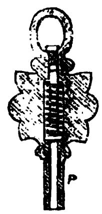


Fig. 2.

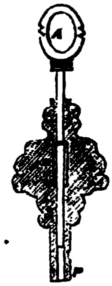
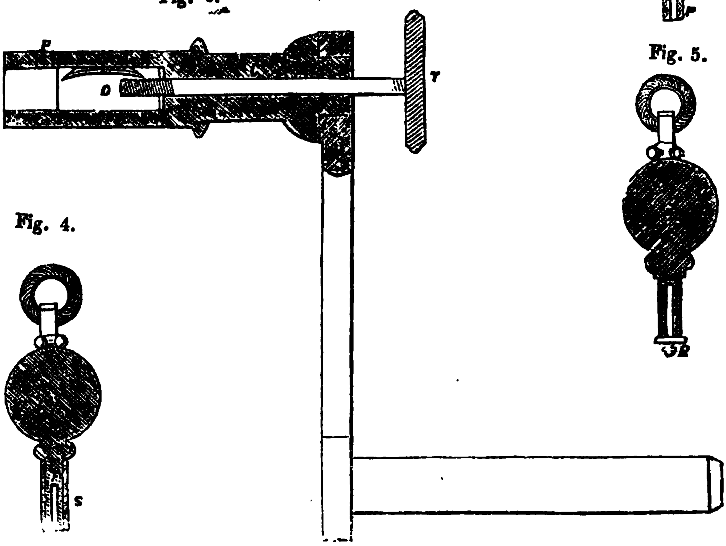


Fig. 6.

Fig. 5.

Fig. 4.



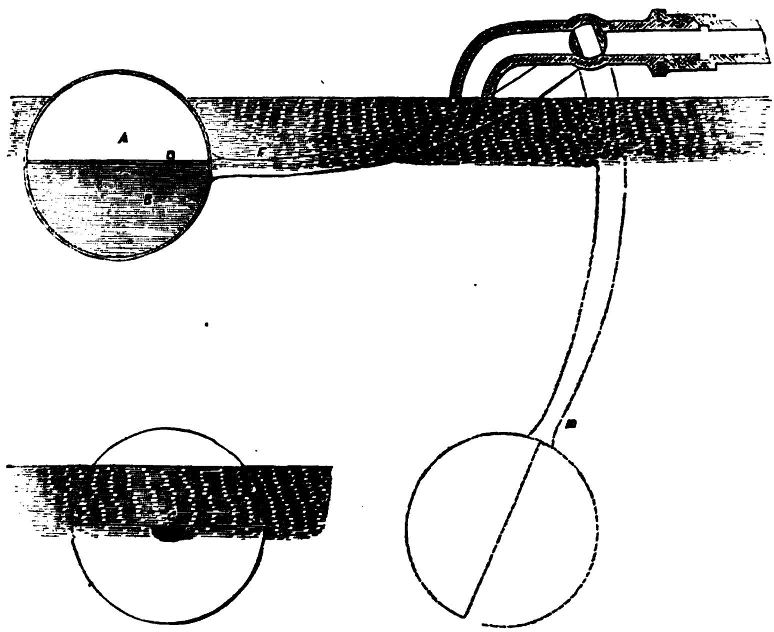
In fig. 2, which is a longitudinal section similar to the preceding, of a watch-key on a different plan, the aperture of the pipe, P, is also kept closed by a sliding square or piston, but the piston rod is directly attached to the bow, A, and the movement to and fro of the square or piston is effected by the pulling up and pushing in of the rod by means of the bow. A side-spring, *m*, is also substituted for the coiled spring.

Fig. 3, represents an external view of a watch-key, differing only from fig. 1 in the body parts being not open, but made box fashion, which conceals the piston rod and spring from view.

In fig. 4 the pipe, P, is protected by a sheath, S, which is taken off when the key is about to be used; and in fig. 5 the same effect is obtained by inserting a solid stopper, R, into the pipe; but I do not recommend either of these modifications on account of the liability of the sheaths and stopper to become loose, and to be thereby mislaid or lost.

Fig. 6, represents a key, which is more particularly applicable to the winding up of clocks; P, is the pipe, which is internally of a square form, but externally round; D, is a square piston which fits the pipe; and C, the piston rod, having a thumb-piece, T, by which the piston is pulled up, or pushed out, as required.

Mr. Preddy's claim is for "the closing of the pipes of watch-keys, and other instruments for winding up watches and other time-keepers when out of use, by means of sliding squares, or pistons, sheaths, and stoppers, as exemplified and described."



Sir,—I beg to introduce to the notice of your numerous readers a lately registered invention of Mr. William Murray's, of University - street, which I believe is the most simple and effective of any which have yet been brought out. Most persons have, at some time or other, experienced the want of such an article—viz., a water-ball, which will obviate the inconveniences arising from the ordinary ball sticking fast.

I have seen the present one used; it answers admirably, is very cheap, and impossible to get out of order, not having any moving parts.

I am, Sir, yours, &c.,
JAMES BUCKINGHAM, C.E.

Description.

The ball is composed of two chambers; viz., an upper one, A, and a lower one, B, separated by a thin diaphragm, D; and a hole is made at the upper portion of the chamber, B, on the side of the ball most remote from its lever and the axis of the cock.

It will be perceived that, supposing the cistern to be empty, and the ball also empty, it will be in the lower position, indicated by dotted lines, and marked E, in which position the cock will be open; then, supposing water to gradually enter the cistern, and rise up to the hole in the ball, it at first will not enter in consequence of the contained air, and the ball will have buoyancy equal to the bulk of the ball less its weight of metal, and will therefore rise on the surface; but, as it rises, the orifice will rise quicker than the centre of the mass, and some air will escape at intervals, being replaced by water; and this will go on until the ball has arrived at the position as at F, when it shuts off the supply, and has itself become charged with water in B.

Now the difficulty (the sticking fast of the ordinary ball) to be overcome, exists only at the commencement of action, for when once slightly moved, it generally does so easily afterwards; and it will be perceived that the buoyant power of this ball is greatest at its lowest position. Again, when full and in position

F, if water be withdrawn from the cistern, the ball, with the charged chamber, B, will be more than sufficient to ensure at all times the proper descent of the mass.

18, Judd-place, East, New-road,
December 14, 1849.

SIR M. ISAMBIRD BRUNEL.

(From the *Times* of the 13th December.)

Our obituary of to-day records the death of this distinguished engineer. By birth he was a Frenchman, but his life and genius were almost wholly devoted to the invention and construction of works of great public utility in this country. Sir I. Brunel was born at Hacqueville, in Normandy, now in the Department de l'Eure, in the year 1760. His family had for many centuries held, and now hold, the estate on which he was born; and the name of Brunel is found constantly mentioned in the ancient archives of the province. He was educated for the church, and was accordingly sent at an early age to the seminary of St. Nicain, at Rouen. But he soon evinced so strong a predilection for the physical sciences, and so great a genius for mathematics, that the superiors of the establishment recommended he should be educated for some other profession than that of the church. His father strongly objected to his adopting the profession of an engineer, as one more likely to prove beneficial to others than himself, and he therefore determined that he should be educated for the naval service, in which he thought his son's proficiency in mathematics might lay the foundation of his advancement in that profession. At the proper age he entered the Royal Navy, being indebted for his appointment to the Mareschal de Castries, then the Minister of Marine. On one occasion he surprised his captain by producing a sextant and quadrant of his own construction, and which he used for making observations. He made several voyages to the West Indies, and returned home in 1792. At this time the French Revolution was at its height. As Mr. Brunel entertained Royalist opinions, which he was not very careful to suppress, his life was more than once in danger, and he was, like many others at that time, forced to seek safety in flight. He emigrated to the United States, where necessity, fortunately, compelled him to follow the natural bent of his mind, and to adopt the profession of a civil engineer. He was first engaged to survey a large tract of land near Lake Erie. He was employed in building the Bowery Theatre, in New York, which not many years ago was burnt down. He furnished plans for canals, and for various machines connected with a cannon foundry then being established in the state of New York. About the year 1799 he had matured his plans for making ship blocks by machinery. The United States was not then the field for so inventive a genius as Brunel's. He determined upon visiting England, and offering his services and plans for this purpose to the British Government. Lord Spencer, then we believe First Lord of the Admiralty, became his friend and patron. He became a frequent guest at Spencer-house, and never failed to speak warmly of the assistance and encouragement he derived from the friendship of Lord and Lady Spencer. From this time he continued to reside in England, and refused to entertain many propositions made to him to leave England and settle abroad under the auspices of other Governments. After much opposition to his plans, for a very powerful interest was arrayed against him, not lessened in that day by his being a Frenchman, he was employed to execute them in Portsmouth Dockyard. To perfect his designs and to erect the machinery was the arduous labour of many years. With a true discrimination he selected Mr. Henry Maudslay to assist in the execution of the work, and thus, possibly, was laid the foundation of one of the most extensive engineering establishments in the kingdom, and in which, perhaps, a degree of science and skill has been combined and applied to mechanical invention and improvement scarcely exceeded by any other in the world. The block machinery was finished in 1806, and has continued ever since in full operation, supplying our fleet with blocks of a very superior description to those previously in use, and at a large annual saving to the public. It was estimated at the time that the saving, in the first year, amounted to 24,000*l*. per annum; and about two-thirds of that sum were awarded to Mr. Brunel

It is needless to describe the originality and beauty of this well-known machinery. Even after the lapse of forty years, notwithstanding the marvellously rapid strides we have made in the improvement and construction of machines of all kinds, it remains as effective as it was when first erected, and unaltered. It is still an object of admiration to all persons interested in mechanics. A few year afterwards he was employed by Government to erect saw-mills, upon a new principle, in the dockyards of Chatham and Woolwich. Several other inventions were the offspring of his singularly fertile mind about this time—the circular saw, for cutting veneers of valuable wood; and the beauti-

ful little machine for winding cotton thread into balls, which greatly extended its consumption. About two years before the termination of the war, Mr. Brunel, under the countenance of the Duke of York, invented a machine for making shoes for the army by machinery, the value and cheapness of which were fully appreciated, and they were extensively used; but, the peace of 1815 lessening the demand, the machinery was ultimately laid aside. Steam navigation also at that time attracted his attention. He was engaged in the building of one of the first Ramsgate steamboats, and, we believe, introduced the principle of the double engine for the purpose. (6). He also induced the Admiralty to allow him to build a vessel to try the experiment of towing ships out to sea, the possibility of which was then denied. Many other objects of great public utility occupied his mind, which in this mere outline of a long and active life must be excluded. The visit of the Emperor Alexander to this country, after the peace, led him to submit to the Emperor a plan for making a tunnel under the Neva, where the accumulation of ice, and the suddenness with which it breaks up on the termination of winter, rendered the erection of a bridge a work of great difficulty. This was the origin of his plan for a tunnel under the Thames, which had been twice before attempted without success. In 1824, however, a company was formed, and supported by the Duke of Wellington, who took from first to last a deep interest in the work. Many men of science also joined it, amongst whom the late Dr. Wollaston was the most prominent, and whose brother long continued one of the most active and able promoters of the scheme. The work was commenced in 1824. It was stopped more than once during its progress by the breaking in of the river, and more effectually at last by the exhausted finances of the company, which never extended beyond the command of 180,000*l*. At length, after the suspension of the work for many years, by a special Act of Parliament a loan was sanctioned, the Exchequer Loan Commissioners advanced the funds necessary for the completion of the work under the river, and, notwithstanding many weighty professional opinions were advanced against the practicability of the work, from both the loose alluvial nature of the soil through which it had to be constructed, and the superincumbent flood of water, it was finished and opened to the public in 1843. In a scientific point of view this work will always be regarded as displaying the highest professional ability, an amount of energy and perseverance rarely exceeded, and a fertility of invention and resources under what were deemed insurmountable difficulties, which will always secure to Sir I. Brunel a high place amongst the engineers of this country. During Lord Melbourne's administration, Mr. Brunel received the honour of knighthood, on the recommendation of the late Lord Spencer, then Lord Althorp. Sir I. Brunel was a vice-president of the Royal Society, a corresponding member of the Institute of France, and a vice-president of the Institution of Civil Engineers. He was also a Chevalier of the Legion of Honour. He was unaffected, simple in his habits, and benevolent, and as ready to do a kind act as he was to forget an injury. He died in his 81st year, after a long illness, which first visited him soon after the completion of the Tunnel. The care, anxiety, and constant strain of body and mind, brought on a slight attack of paralysis, from which he never thoroughly recovered. He leaves a widow, Lady Brunel, one son, the eminent engineer, and two daughters, the eldest married to Mr. Hawes, the Under-Secretary of State for the Colonies, and the youngest to the Rev. Mr. Harrison, the vicar of New Brentford.

Note.

The writer of the preceding memoir has been much misinformed as to the circumstances attending Mr. Brunel's first appearance as an inventor in this country, and the introduction of the block-cutting machinery, which formed the basis of his renown. Far from encountering "opposition to his plans"—the usual fate of inventors—Brunel had the rare good fortune to be taken at once by the hand by the man who, of all others at the time, was the best able to promote his views, and whose own reputation and interests, moreover (a stranger thing still) stood most in the way of a hearty recognition of the strangers merits. Neither was Lord Spencer by any means "the friend and patron" to whom Brunel was so wonderfully beholden; his lordship was but the chief of the Board of Admiralty of the day, which, at the pressing instances of the real benefactor in the case, the late Brig.-Gen. Sir Samuel Bentham, sanctioned the employment of Brunel and the erection of his machinery. We quote the following authentic history of the entire transaction from one of General Bentham's publications, and are happy to add, that the generous and high-minded part which he acted on the occasion does not rest on

his own testimony alone, but has been recognized in the most handsome and satisfactory terms by one of the most eminent writers of Brunel's own country, M. Charles Dupin, who derived (as we have occasion to know) all his information on the subject directly from Brunel himself. M. Dupin, in his *Force Navale de la Grande Bretagne*, vol. ii., p. 251, adverts to the block-cutting machinery in these terms:—

"Le Général Bentham avait formé des projêts pour toutes ces machines; il s'appretait à les mettre en exécution, lorsque M. Brunel (alors inconnu), vint lui présenter d'autres plans pour effectuer les principaux travaux de poulierie. Le général répondit, sur le champ, à l'artiste; 'J'ai moi-même imaginé des machines pour faire des poulies, et voici mes moyens d'exécution. Maintenant je vais examiner les vôtres.' Non seulement le Général Bentham les trouva meilleurs que les siens, mais il renonça dès cet instant à son propre travail, et se déclara pour l'adoption des projets de son compétiteur. *J'aime à citer de pareil traits; ils font honneur à l'homme.*"

Yes, truly, such conduct did indeed honour to humanity.

As little is it correct to say that the judicious selection of Mr. Maudslay to do the work was owing to the "true discrimination" of Mr. Brunel. For, long before Mr. Brunel made his appearance, Mr. Maudslay had been employed on the recommendation of Sir Samuel Bentham do a great deal of work for the public dockyards. If the greatness of the engineering establishment of Messrs. Maudslay and Co. is really to be traced to early government patronage, it is to Bentham much rather than to Brunel that it has been owing. We apprehend, however, that Mr. Maudslay's executive talents were of so high an order as to place his success much beyond such accidental chances as the recommendation of this or that individual; they were such as to recommend rather than solicit patronage—not the patronage of Government Boards alone (but too often obtained by sycophancy and *finesse*), but the patronage of the public at large.

The statement of Sir Samuel Bentham is in these words:—

"It happened while I was unremittingly employed in drawing up the regulations, forms for accounts, and other arrangements requisite for the introduction for my new plan of management for timber, that a foreigner, at that time unknown to me, presented himself with drawings of machinery for block-making, but which at that time embraced only some of the operations requisite in forming the shells for blocks: the drawings exhibited great ingenuity and mechanical skill, and on conversation with him I found his ideas on mechanical subjects just and extensive; and I learnt that he had invented several other machines well known for their use and ingenuity. Finding that his time was unengaged, his application to business steady, at the same time his manners prepossessing, his connections in this country such as to do away the objections to him as a foreigner, I saw reason to conclude that the services of this gentleman, Mr. Brunel, might be made very useful to the public in forwarding the introduction of machinery of the nature of that he offered, provided only it could be made his interest to apply himself exclusively to that object, and in such manner as that his remuneration should depend on the degree of his success. I therefore advised him to address himself to the Admiralty, proposing the introduction of his machinery for the manufacturing of blocks in Portsmouth dockyard. That proposal having been made accordingly, and referred to me for my opinion, I recommended the adoption of it, mentioning at the same time that the making of blocks, as it was known to the then Lords of the Admiralty, was one 'of the purposes for which it was intended to employ a part of the force of the steam engine erected in Portsmouth dockyard for the occasionat purpose of pumping the docks,' and at the same time I further recommended, 'that Mr. Brunel should be directed to concert with the mechanist in my office,' Mr. Goodrich, 'respecting the best mode of fixing up the different engines and apparatus which may appear requisite for the manufacturing of the different sorts and sizes of blocks, so as that this apparatus should combine with the other machinery already provided, or which it may seem advisable to erect in that dockyard; and that Mr. Brunel may be likewise directed to give into my office drawings and estimates of the expense of the whole of the machinery, which may appear to him necessary for this purpose,' adding that 'I should then be enabled to submit to their Lordships my further opinion respecting what had best be done for the introduction of this mode of making blocks for the general service of the dockyards.' Their Lordships having accordingly determined that Mr. Brunel's machinery in question should be introduced in the manner I had suggested, Mr. Brunel employed him-

self in the perfecting of his machinery, in the adapting of it to the particular demands of the navy, and in concert with the mechanist, in contriving the best mode of putting it up at Portsmouth, of combining it with the other machinery erecting or intended to be erected there, and in arranging machinery for various operations in block-making, for which neither Mr. Brunel's machinery nor such of mine as was already prepared, were suitable. Whilst he was so employed, on his having made application to the Lords Commissioners of the Admiralty soliciting remuneration; and on their Lordships having been pleased to refer his letter to me with orders that I should consider and report what in my opinion might be proper to be done on the subject of that application, I suggested the expediency of paying Mr. Brunel at the rate of a guinea a-day for the time he had been or might be actually employed in directing the execution of his machinery in itown, and in superintending the erection of it at Portsmouth, with an addition of ten shillings a day when absent from town, as an immediate compensation for his time so employed, and his expenses during such absences; but instead, as he had proposed, of his being to be allowed to make what profits he could by furnishing the machinery requisite, I suggested the expediency, for reasons given, of remunerating him upon the principle mentioned, Article 15, under the head of Management; both of which suggestions having been adopted by their Lordships Mr. Brunel continued to be employed in the preparation, setting to work, further improving and extending his machinery in concert with the mechanist, and under my superintendance, till the time of its completion.

"Such having been my proceedings in this business, they have not passed without imputations of blame; those who had seen my machinery at work, and those who saw the specification of a patent I had taken out several years before included most of the operations and the modes of performing them which were introduced in Mr. Brunel's machines, perceived no need for my having recommended the employment of a stranger for the bringing to perfection any such business as that of block-making; these observations were more particularly pressed by those who knew that I had an assistant in my office, the mechanist, who was fully competent to the production of any mechanical effect; and that I had at command the services of a man (Mr. James Burr) who had been many years employed in the management of the machinery I had invented, and which had been adapted to the giving shapes more complicated than those of blocks. The having therefore for the protection of analogous effects recommended the making a temporary allowance to another person, equal to the mechanist's salary, with the conditional assurance of a future remuneration to a far greater amount, seemed unjust to my assistant, and an unnecessary expense to the public; more especially as those who see that a great part of the preparatory work in converting the wood ready for the shaping of the shell was from the first performed by some even of the identical machines spoken of in Articles 1, 2, and 3, as having been seen at work at my brother's residence,* notwithstanding which the remuneration given to Mr. Brunel was at last calculated upon the work done by my machines, as well as by those of his own invention. These circumstances were all of them obviously entitled to consideration, and were in fact none of them overlooked by me: but to judge of my conduct on this occasion, there are other circumstances to be taken into the account. My own time at the period in question could not suffice for the details in the introduction of mechanical improvements, and at the same time for those for improvements relative to dockyard management, and this their Lordships, I had reason to believe, looked on as an occupation in which my services were of importance superior even to that of the introduction of machinery; and the mechanist was very beneficially and fully employed on various other mechanical improvements, as well as in giving general assistance in the arrangement of the block machinery. I cannot therefore but feel myself justified in having recommended the engaging of Mr. Brunel's services for this purpose; nor is it likely that any other mode of remuneration would have rendered these services so beneficial to the public as the particular one I recommended, which combined his interest so intimately with that of the public.

"As to the calculation of this remuneration, it had been represented as impracticable to make it, and the making it out became my task: indeed there were circumstances attending this case of remuneration which, considering the various ways in which I was concerned in the production of the effect, rendered it to *me* a business of peculiar difficulty. There were savings derived from the use of improved machinery, savings of manufacturers' profit, and savings from good management in the concern as a manufac-

* The machinery of mine, here mentioned had, great part of it, been made by Mr. John Lloyd, who before I entered His Majesty's service, worked exclusively for me; but is now in great repute as a master millwright, and is employed very largely by the Ordnance Board, as well as for the Naval Departments, particularly for the erection of cranes.

tory. In regard to the savings in the block manufactory from all these sources, it was either by Mr. Brunel's means or by mine that they had been produced; it had often been observed to me that, in regard to the machines of Mr. Brunel's invention and arrangement, ingenious as they are, and insuring as they do the accuracy of the operations they perform, still in point of saving, that produced by these machines is, in fact, not very considerably greater than what is produced by other machines in use by private blockmakers; and it had also been represented to me, as already stated, that the savings produced by the machines mentioned in Articles 2 and 3, are not inconsiderable, and ought not to be included in the calculation upon which Mr. Brunel's remuneration was to be grounded. For my own part, upon observing the great difference of the totals resulting from the savings, as calculated by Mr. Brunel (21,174*l.* 12*s.* 10*d.*), and by Mr. Rogers, clerk in the Secretary's Department, at the Navy-office, who had been entrusted with making the requisite calculations on the part of government, and still further, the difference between the result of the two calculations which Mr. Rogers had made (6,691*l.* 7*s.* 4*d.*, and 12,742*l.* 8*s.* 2*d.*), according as he had taken as a standard the price paid to one or to the other, of two contractors who served blocks for the use of the navy, I thought it a duty incumbent on me, to enter myself into a great variety of details on the subject of the remuneration. In going through these details, I found it would be attended with all the trouble and delay of making a certain number of blocks by hand, so as to have enabled me to calculate, not only what part of the saving was produced by the machines altogether, but by each of the machines in particular, had I determined to have distinguished what part arose from the use of machinery in general, what part from Mr. Brunel's machines, what from mine; and again, in regard to the savings arising from the savings of manufacturers' profit, and those arising from any particular good management, it would have been so very arbitrary to have fixed upon what portion of these savings arose from the particular management which I had caused to be introduced, that I myself, being the person in competition with Mr. Brunel, in both respects, could not, in the particular circumstances in which I was placed, bring myself to specify any savings made by my means in this manufacture, as a deduction to be made from Mr. Brunel's reward; the less so, as in regard to my machinery, *I was satisfied that Mr. Brunel had skill enough to have contrived machinery to have answered the same purposes, had he not found mine ready to his hands.* In regard to the management also, I had found Mr. Brunel enter so fully into my ideas, and second me so well in the selection of work people, at the commencement of this business; attending to their progress, and even giving those who showed particular instances of desire to acquire dexterity, or who were remarkable for industry, some little reward out of his own pocket, that I really did consider him as deserving some remuneration for the trouble he took in forwarding, in these respects, my views in regard to general management; and farther, as I had considered it highly conducive to the hastening the introduction of a general system of machinery, that public opinion should be obtained in its favour, and that this was likely to be more surely effected by a display of well-arranged machines, for the accomplishing of one particular object, I determined, as the machines which it might be expedient to employ exclusively for blockmaking, admitting of a pleasing arrangement, that the whole should be placed to the best advantage in point of appearance as well as use; postponing the introduction of, and even removing such parts of the system of machinery, mentioned in articles two and three, as might stand in the way of the block machinery, reserving only those which were requisite for his business; not doubting but that Mr. Brunel, being then almost constantly on the spot, and interested as he was to bring the advantages of this particular machinery to full view, would engage public opinion in favour of the introduction of machinery in general; indeed, this effect, as the machinery came into use, he did not fail in producing, inasmuch, that his representation of the advantages of machinery in general, might well occasion the multitude who visited the wood-mills, to ascribe to him the introduction into the dockyard of the machinery of every kind that had been introduced. But howevery my credit may have been affected in consequence of such an opinion, I feel no regret in reflecting on any part of my conduct in this transaction; and, in as far as regards the remuneration I calculated to be due to Mr. Brunel, I flatter myself that their Lordships approved of my conduct in this respect at least, since after having considered my explanations on the subject as well as those of Mr. Rogers, and of the Navy Board, they were pleased to sanction the remuneration to Mr. Brunel, as calculated by me; including it in the savings upon a variety of blocks and blockmakers' wares, made in the wood-mills without the assistance of Mr. Brunel's, or with little, if any, assistance from any machinery."

RECENT AMERICAN PATENTS.

(From the *Franklin Journal*.)

IMPROVEMENT IN MAKING CORES AND MOULDS FOR CASTING METALLIC PIPES AND TUBES. *Chapman Warner.*

Claim.—"An improvement in the core tube, caused by screwing it by a longitudinal slit, to allow of compression as the metal contracts in cooling.

"2nd. A manner of compressing a coating of sand upon the improved core tube, or upon any core tube or rod, (or the formation of solid sand cores,) by means of sections operating by machinery, one of the said sections being stationary, towards which another section is forced in a direction perpendicular to its plane, and the two other sections being forced towards each other, between the two first described.

"3rd. In combination with the abovementioned core-box sections, or any other analogous core-forming sections, the (slightly elastic) core tube, bearing plates and caps, or their equivalents.

"4th. A manner of compressing the sand into a half flask, and giving it the impression of the patterns, by placing the pattern at the base of a forming-box and covering it with sand, and then placing the half flask upon the sand covering the pattern, and forcing it down upon the same.

"5th. A manner of preserving the cores in a central position within the moulds, by means of a concavo-convex skeleton or open stays, formed of thin narrow sheets of metal, and combined with a core and mould."

AN IMPROVEMENT IN THE MANUFACTURE OF VINEGAR. *James Ruggles.*

The patentee says,—"The principle of my invention is a discovery which I have made, viz., that the swill or slops of whiskey distilleries, and of other manufactories employing similar materials, contain a large amount of the elements of vinegar. Such slops or swills likewise contain a considerable quantity of other ingredients not capable of forming vinegar, from which it is necessary to free them before completing the chemical process of transforming them into vinegar. Without such purification, the proper rapidity of action could not be attained, and a process of putrefaction would ensue both offensive and deleterious. The nature of my invention consists in the application of means for economising a substance now generally thrown away as useless."

Claim.—"Making of good wholesome vinegar from the slops or swill, commonly so called, being the waste or spent liquors of distilleries and other manufactories.

"2. Making of vinegar from the combinations of slops or swills, or spent liquors of distilleries, breweries, starch manufactories, and other workshops in which vegetable substances have undergone fermentation and partial decomposition, with vinous, or alcoholic, or any lacetous, saccharine, or other vegetable materials added thereto, when employed to increase the strength of vinegar, manufactured from said slops or swills, waste or spent liquors.

"3. The combination of apparatus for effecting the several successive processes of converting the slops or swills of distilleries and other manufactories, and the mixtures of the same, with other materials added thereto, to increase the strength of the vinegar.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 20TH OF DECEMBER, 1849.

MICHAEL JOHN HAINES, John-street, Commercial-road East, leather-pipe maker. *For improvements in the manufacture of packing for steam engines, cylinders, and other purposes, "part of which improvements are applicable to the manufacture of waterproof fabrics and leather."* Patent dated June 14, 1849.

The patentee, who disclaims the part of his title included within the inverted commas, states that his invention consists in manufacturing a packing for pistons and stuffing-boxes of a number of pieces of canvas or other fabric, arranged in horizontal or vertical layers, and united together by some suitable cement capable of resisting the injurious action of steam, hot water, and spirits.

Claim.—The manufacture of packings for steam-engine cylinders, pistons, and other purposes, and for stuffing-boxes and other purposes in which the piston or instrument moves through the packing.

JOSEPH BURCH, Craig-works, Macclesfield, engineer. *For improvements in printing on cotton, woollen, silk, paper, and other fabrics, and materials.* Patent dated 14th June, 1849.

The patentee describes and claims,

1. The employment of several block-machines, connected together by shafting, for the purpose of producing, simultaneously, impressions of the same design in different colours.

2. A mode of passing the fabric to be printed through the printing-machine by means of an endless band, with projecting pins upon its upper surface, and bands of

metal, or some non-elastic material, and guide-rollers, to ensure the necessary regularity and exactitude in the repeated printing thereof.

3. The applying of colours to fabrics by mechanical means, varying the pressure at each successive impression, so that the first may force the colour into the body of the fabric, and the last merely apply it to the surface

4. Causing the printing-rollers to come, alternately, into contact with the sieve rollers, and thereby present the flushing of the colour.

5. Constructing the drum in roller printing-machines of sufficient diameter to allow of the fabric being wound thereon, to the extent of the design to be printed, without over-lapping; and fitting toothed wheels on the drum, and on the axis of the printing roller, so that the same portions of the printing roller may come opposite the same portions of the fabric in the successive revolutions of the drum and roller.

6. A mode of retaining the fabric in position by means of pins and non-elastic bands, so arranged as not to injure the surface of the printing-roller.

7. A method of cutting out the surfaces of printing rollers into squares or checks, previously to drawing the pattern or design thereon.

8. An arrangement of machinery for printing both sides of a ticket at the same time, and changing the figure on the reverse side to correspond with the progressive unit on the other side.

9. Damping fabrics, previously to their being printed, in order that they may the better take up the colour.

PETER WILLIAM BARLOW, Blackheath, C. E. *For improvements in parts of the permanent ways of railways.* Patent dated June 14, 1849.

Claims. — 1. Combining two or more chairs, or supports, or parts of two or more chairs, or supports, in the same sleeper or bearer.

2. Making chairs to be affixed to sleepers in parts [and uniting them by screws, bolts, or otherwise, to form bearings for the rails.]

RICHARD HEMSLEY DAY, Halford, Essex, *hydro-fuse manufacturer. For improvements in the manufacture of emery paper, emery cloth, and other scouring fabrics.* Patent dated August 1, 1849.

The object of this invention is to produce a scouring fabric which will not be affected by damp or moisture. For this purpose, the paper, cloth, or other fabric, is coated with a composition consisting of 3 parts boiled linseed oil, 2 parts African opal, 1 part Venice turpentine, 1 part Venetian red, $\frac{1}{20}$ part Prussian blue, and $\frac{1}{20}$ part litharge. The emery, glass, or other scouring substance, is sifted thereon in the usual manner. After this, the other side of the fabric is subjected to the same treatment, in order to render both sides available for scouring purposes.

Claims.—1. The manufacture of emery paper, emery cloth, or other scouring fabric by a waterproof cement.

2. The manufacture of emery paper, emery cloth, or other scouring fabric with the scouring composition on both sides thereof.

JOHN DEBELL TUCKETT, Plymouth, Devon, merchant. *For a new and improved method of preparing a manure called superphosphate of lime, without using any acids in the decomposition of the various substances of which the manures now in use, and for which patents have been obtained, called superphosphate of lime, by the application or artificial agency by which more than double the quantity of true superphosphate of lime can be produced beyond that for which any patent has hitherto been granted, that the same may be applied in the production of all kinds of crops, more particularly wheat, barley, oats, turnips, and other vegetables.* Patent dated October 18, 1849.

The simple object of the invention, set forth in the above verbose, ungrammatical and unintelligible title, is to obtain the phosphate of lime from the substances in which it is contained, without employing sulphuric acid, and, consequently, at a cheaper rate. For this purpose the patentee employs two cylindrical vessels, termed "digesters," capable of sustaining, without injury, a pressure of 100 lbs. to the square inch, which are set in brickwork and provided with man-holes, stopcocks, and refrigerators. Between, and communicating with them, is a steam boiler, which is fitted with a safety-valve. Bones, bone-dust, or horns are placed in the digesters, and subjected to steam of a pressure varying from 29 lbs. to 100 lbs. per square inch, at a temperature of from 150° to 235° Fahr. At first, the steam is employed at a low temperature and pressure, to drive the fatty matters into the refrigerator, whence they are removed. The pressure and temperature of the steam are increased to expel the gelatine; after which, what remains will be superphosphate of lime, which may be reduced to a finer state by any ordinary method, if desired. When it is required to obtain the gelatine in a delicate state, the steam is admitted at a lower pressure, and the operation conducted at slower rate than before.

No claims.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Robert Harcourt, of Birmingham, manufacturer, for certain improvements in knobs, handles, and fastenings for doors and drawers, and in fastenings to be used in fastening window sashes, curtain and other rods, and for other like purposes. December 15; six months.

James Oldknow, of Lille, France, lace manufacturer, for improvements in the manufacture of lace and other fabrics. December 15; six months.

Henry Roberts, of Connaught-square, Hyde-park, gentleman, for improvements in the manufacture of bricks and tiles. December 15; six months.

George Wythes, of Reigate, Surrey, contractor, for improvements in apparatus for receiving and retaining the rails of railways. December 15; six months.

Alfred Dalton, of West Bromwich, Stafford, iron-founder, for improvements in reverberatory and other furnaces. December 15; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, for improvements in instruments for measuring, indicating, and regulating the pressure of air, steam, and other fluids, and in instruments for measuring, indicating, and regulating the temperature of the same, and in instruments for obtaining motive power from the same. (Being a communication.) December 15; six months.

Charles Lizars, of Paris, engineer, for improvements in gas meters. (Being a communication.) December 15; six months.

Thomas Rock Shute, of Watford, Hertford, silk-throwster, for improvements in spinning, doubling, and throwing organzine silk. December 15; six months.

Timothy Hackworth and John Wesley Hackworth, of the Soho Works, Shilden, Durham, engineers, for improvements in locomotives and other engines. December 15; six months.

Benjamin Fawcett, of the Old Jewry, builder, for improvements in pigments, paints, and vehicles for painting. December 15; six months.

Isaac Lewis Pulvermacher, of Vienna, engineer, for improvements in galvanic batteries, in electric telegraphs, and in electro-magnetic and magneto-electric machines. December 15; six months.

Richard Hobson, of Leeds, York, doctor of medicine, for certain improvements in the manufacture of horse-shoes, and in apparatus for taking the measurement of horse-shoes or horses hoofs. December 15; six months.

Edward Lyon Berthon, of Fareham, Southampton, clerk, master of arts, for certain improvements for ascertaining and indicating the course or way velocity, trim, and draught of ships, and the rate of currents; also for discharging water from ships, and for taking altitudes and levels at sea and on land. December 19; six months.

James Smith, of Deanston, Perth, now residing in Glasgow, for certain improvements in treating the fleeces of sheep when on the animals. December 19; six months.

William Ackroyd, of Birkenshaw Mills, near Leeds, York, for improvements in dressing and cleaning worsted, and worsted mixed with cotton, and other fabrics after they have been woven. December 19; six months.

Warren de la Rue, of Bunhill-row, manufacturer, for improvements in the manufacture of envelopes. December 19; six months.

Frederick Hale Thomson, of Berners-street, Oxford-street, Middlesex; and Edward Varnish, of Kensington, in the same county, for improvements in the manufacture of inkstands, mustard-pots, and other vessels of glass. December 19; six months.

Henry Fox Talbot, of Laycock Abbey, Wilts, Esq.; and Thomas Augustine Malone, of Regent-street, photographer, for improvements in photography. December 19; six months.

Joseph Whitworth, of Manchester, engineer, for certain improvements in machinery or apparatus for cutting metals, and also improvements in machinery or apparatus applicable to agricultural and sanatory purposes. December 19; six months.

Frederick George Spray, and George Nevett, of Hamptead-road, engineers, for an improved steam-engine, parts of the arrangements of which may be applied to apparatus for regulating, measuring, and registering the flow of liquids and gases. December 21; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Dec. 13	2119	John Ambrose Coffey	Sydney-street, Commercial-road	Chemical apparatus.
14	2120	William Wilson	Wandsworth Common	Beetle-trap.
15	2121	Thomas Key	Charing-cross	Double-keyed slide trombone.
,,	2122	John Remington	Shaftsbury Crescent, Pimlico	Balcony fire-escape.
18	2123	Isaac Whitesmith	Rose-street, Glasgow	Spindle and flyer.
,,	2124	George Rush	Elsenham Hall, Essex	Dials for the aneroid barometer.
19	2125	George Clark Rout	Portsmouth	Riding trousers.
,,	2126	John Mayes	St. John-square	Razor strop.
,,	2127	Joseph Dawson	Islington	Cravat.

NOTICES TO CORRESPONDENTS.

Errata.—*Page* 563, *line* 2, *of the* 1*st Example. Expunge the* 1 *in* 15, *and the dash over the* 3.

Page 576.—*In the account given of the successful application of the Disc engine to the* Minx *steam-vessel, the engine was stated to have been "fitted by Messrs. Bryan and Dorkin"—an error of the press which hardly needs correction, but it is still necessary to correct, as Messrs.* Bryan, Donkin, *and Co., (the firm referred to) though known to all the world as makers of paper-making and other descriptions of land machinery, have not hitherto (we believe) made any trial of their skill in marine steam-engine building.*

CONTENTS OF THIS NUMBER.

Mechanics' Magazine,

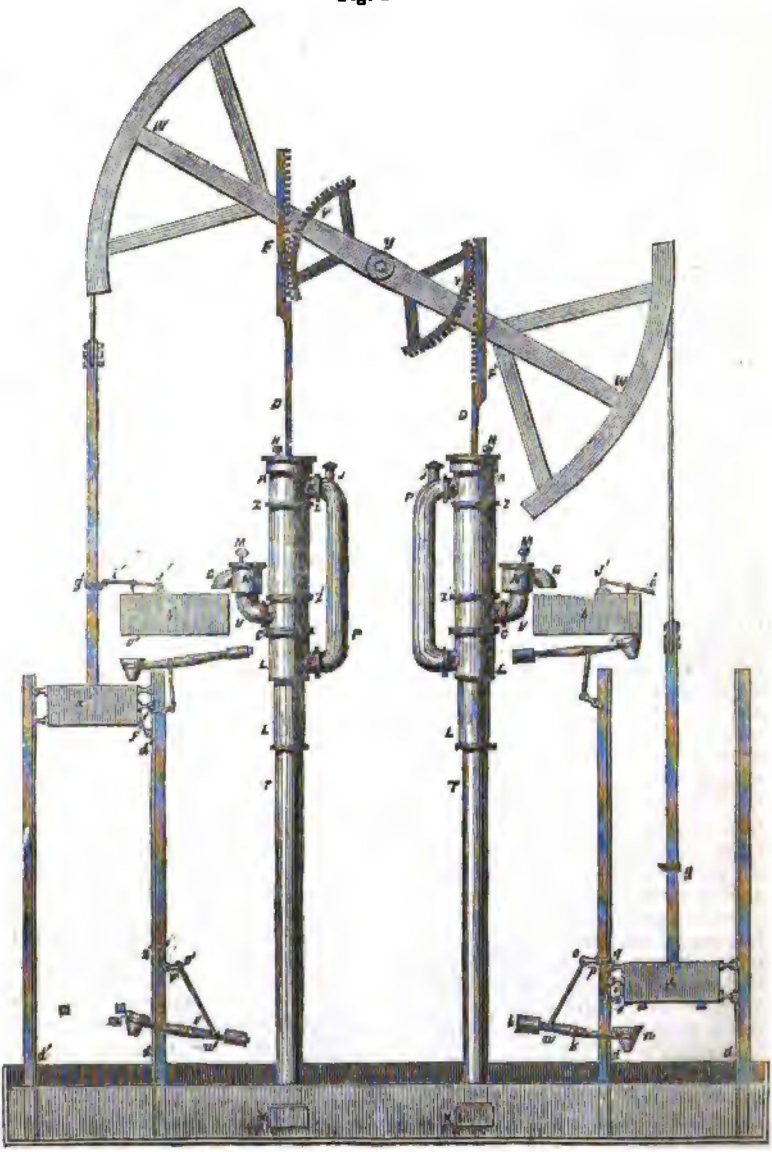
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1377.] SATURDAY, DECEMBER 29, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

LOMBARD'S PATENT HYDRAULIC ENGINE.

Fig. 2.



LOMBARD'S PATENT HYDRAULIC ENGINE.

[Patent dated June 9, 1849, in the Name of Mr. Joseph Samuda, as a Communication from Abroad. Specification enrolled December 9, 1849.]

(From a Correspondent.)

To all those who reflect upon the rapid strides that have been made of late years in every branch of mechanics, it must be matter of surprise that the science of hydraulics has made comparatively so little progress. Various contrivances, it is true, have been applied to the raising of liquids, by means of which a much larger quantity of fluid can be raised in a given time than could have been effected some years ago; but these improvements, however valuable, have rather had reference to the motive power by which pumps and other hydraulic machines may be worked, than to those machines themselves.

Every person who is but cursorily acquainted with the principles upon which pumps are constructed, must be aware that there is one feature common to them all, however varied they may be in their form. They have all a piston, with or without a valve, that by moving in a cylinder, to which it is closely fitted, produces a vacuum in one part (generally the lower) of the cylinder, which is then filled by the pressure of the external air upon the well.

The surface of the piston, which is on the other side of the vacuum, is invariably exposed, mediately or immediately, to the action of the external air.

Now, as there is a vacuum on one side of the piston, it follows that each alternate stroke, either upwards or downwards, as the case may be, must be met by a resistance equal to a column of air of the height of the atmosphere, having for base the area of the piston, or equal to a column of water having the same base, and an altitude of 32 feet. This being the utmost that can be raised by the pump, it follows that the force to be applied to working the pump must in all cases be equal to the weight of water to be raised at each stroke, *plus* the friction of the piston, &c.; so that if a ton of water were proposed to be raised at each alternate stroke of the piston, a motive power of more than a ton weight must be applied.

The great desideratum is then to neutralize the resistance of the atmosphere, and this object appears to be attained in a very simple manner, by the pump recently invented by Mr. Lombard, of Paris.

It will be seen that advantage is taken of the well-known property which fluids possess of pressing upwards and downwards, to place the piston between two columns of water, so that the ascent is favoured by a force equal to that which opposes it, while the adjunction to the piston of a cylindrical box, whose bottom is pressed downwards at the same time as the piston itself is pushed upwards, neutralizes the action of the atmosphere, to which the piston is exposed, in descending.

The solution of this problem of neutralizing the resistance of the air and water has led to the solution of that other problem, so often tried in vain, of working pumps by the alternate ascent and descent of boxes filled with water; and if no disturbing cause should arise to interfere with their proper action, it cannot be denied that the new invention will be of signal service in mining and all other operations where it is necessary to extract large quantities of water.

All this may be better appreciated on a perusal of the following Specification, which has been deposited by the nominal patentee, Mr. Samuda:

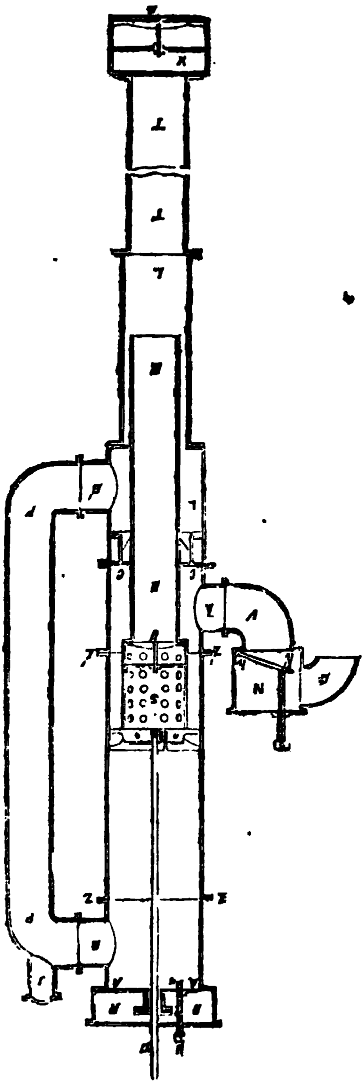
Specification.

The said invention consists in obtaining a motive power from the rising and falling of water reservoirs or boxes, that fill and empty themselves alternately, and a certain arrangement of machinery or apparatus by which the water is supplied for that purpose with as little frictional resistance as may be. The most novel and essential feature of these arrangements, is a pump of a peculiar construction, a side elevation of which is given in fig. 1 of the accompanying illustrations. A A, C C, is a cylinder, having a lateral and horizontal arm on the upper part at B, and another lateral and horizontal arm at K: O O, is a piston, the limit to the ascent of which is the line Z Z, and the limit to its descent the line $Z^1 Z^1$.

The cylinder may be in one piece, but it is better divided into three parts, as in the figure, viz., the middle one Z Z, $Z^1 Z^1$, and the two ends A A, Z Z and $Z^1 Z^1$, C C,

and their respective arms, B and K, which are firmly united to it.

Fig. 1.



The top of the cylinder at A A is hermetically closed by a covering of metal, leather, or other substance. On the middle of this is placed a stuffing-box I. A hole is made in the middle of the covering both of the box and of the cylinder, just large enough to admit the piston rod. Upon the covering of the cylinder a shallow circular reservoir, R R, is placed, which has a cover, through which a screw, H H, runs, penetrating also through a hole in the covering of the cylinder, which it closes very accurately. To the arm, K, in the lower part of the cylinder is jointed a bent tube, V, surmounted by a chamber, N, in which is the spout, G. On the top of the bent tube, V, is a valve, $h\,h^1$, opening upwards. This valve may have its hinge at the circumference, h, or near the middle; and in either case the point, h^1, of its circumference nearest the spout should be rather lower when the valve is down than the opposite one, h. The extremity of the spout, G, is placed above the level of this latter point, h.

Fig. 3.

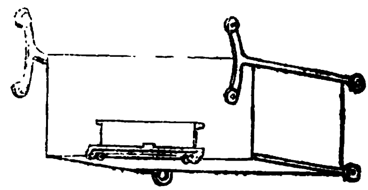


Fig. 4.

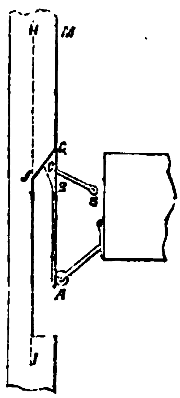
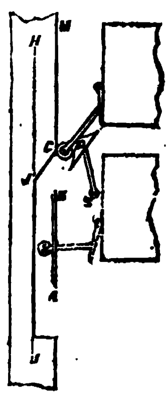


Fig. 5.



The undermost part C C, of the cylinder is closed in a water-tight manner by a stuffing-box; in the centre of that there is a hole, just sufficient to allow the passage of the tube E E. To the base of the cylinder is jointed another tube L L. Its uppermost part has a lateral horizontal arm B^1, exactly corresponding to the upper arm B, and these two arms are united by a tube,

P P, which is joined to them at each end; which last tube P P, has a small perpendicular arm J, rising rather higher than the top of the cylinder A A, and surmounted by a cover screwed on it, and capable of hermetically closing it.

To the tube, L L, may be joined one or more tubes, T; the bottom part, X, is immersed in the water to be pumped up, and closed at its lower extremity by a valve, Q, opening upwards. The piston, O O, is composed of one or more plates of metal, closely packed, to prevent the passage of air or water between the piston and the cylinder. In or near the middle is a small hole, to allow the egress of air when required. To the undermost part of the piston is jointed a small cylinder S, which is pierced all round with holes, whose united superficial contents must not be less than that of the horizontal section of the tube E E. This cylinder, S, has a bottom closely adapted to it, but having a large circular opening in the centre just sufficient to admit the tube E E, which is joined to it. The upper part of the tube E E, is closed by a valve U, which opens upwards into the cylinder S, and may have a hole to admit of the passing of the air. The tube E E, is a little longer than the middle part of the cylinder Z Z, $Z^1 Z^1$. The piston rod D D, is fixed to the piston, as in fig. 1, or joined to it by a bridge, in order to leave the middle free, and it may be worked either as in fig. 2, by a rack and toothed wheel, substituting a handle for the motive power there shown, or in any other way.

Above the valve $h h^1$, of the bent tube, V, is a screw M, by which it may be kept firmly shut when required. The entire height from the surface of the water to be pumped to the top of the cylinder, A A, must not exceed 32 feet. In order to work the pump, the valve, $h h^1$, is kept down in the way described, the screw H at the top of the cylinder taken out in order to leave a passage for the air, and the cover of the arm, J, unscrewed. Water is then poured in through J, which passes down the bent tube P P, and fills the lower parts of the tubes from the valve Q, which remains closed, whence, gradually ascending, it forces the air through the valve at the top of the tube E, and thence through the hole in the piston. As more water is poured in, the piston is forced upwards till it arrives at the highest level Z Z, and the fluid introduced through J passes then by the arm B, and fills the part A A, Z Z, driving out the air through the hole left by the screw at H, and the whole body of the pump and the tubes connected with it are now filled with water. The screw M, is then raised, to allow free play to the valve at the top of the bent tube, V; the screw, H, is again inserted into the top of the cylinder A A, and the box or reservoir R R, filled with water, upon which the pump is in a fit state for working.

As long as the piston descends, the valve at the top of the tube E E, remains shut by the mere effect of the fluid above it, and the water below the piston having no other issue but the bent tube V, opens the valve, $h^1 h$, at the top of it, and passes out through G. As fast as the piston descends, the space left above it is filled by the atmospheric pressure forcing the water to open the valve Q, and to rise up the pipes T and L, and pass thence through B^1, P P, and B.

When the piston arrives at its lowest point $Z^1 Z^1$, the valves $h^1 h$, and Q, shut from their own gravity, and remain so as long as the piston continues its upward course.

When the piston is raised, the water is displaced above it, and passes through the arm B, thence through the bent tube P P, and finally through B^1 into the tubes between the cylinder and the valve Q; the water thus introduced passes up the tube E, forces open the valve U, and at length passes through the holes in the circumference of the cylindrical box S, into the space below the piston.

Thus at each ascent of the piston the water is not thrown out, but merely displaced, and this with as little resistance as may be, since the downward pressure of the column above it is neutralized by the upward pressure of the column below it. On the other hand, while the piston descends, whatever pressure the external air at the opening of the valve, $h h^1$, may exercise on the water below the piston, it will act as much downwards upon the valve in the cylindrical box, S, as upwards upon the piston itself with which the cylindrical box is united, so that here also the forces will be neutralized.

It is this absence of resistance through the neutralization of the forces which forms the groundwork of the invention.

The spout, instead of being placed below the level of the piston, may be placed at any height above it, without materially increasing the effort required to work the pump.

A combined action of two pumps may be effected in many ways; one, among others, would be by placing a trough between the two spouts to receive the water as it issues from them, and by working them together by a rack or toothed wheel, or in any other manner.

Another mode would be, by joining the tubes L L, of two pumps by a third bent one T T, to which there should be joined a pipe of communication with the water to be raised, common to both pumps.

Another mode, again, would be by preserving the same arrangement as just spoken of, but supressing the arm B^1, at the lower part of the cylinders, as well as the bent tubes P P, and uniting both cylinders by means of a horizontal pipe. The tube, by means of which the body of the pump, with its adjuncts, is filled with water, in order to put it in a working condition, should then be joined to the bent tube of communication, and should open as well into the horizontal tube above.

The communication between the two cylinders may take place from B to B, as in the instance just cited, but without any second communication; the pipe J, being still joined to the lower part of the cylinder or pipes below it, and communicating as well, with the horizontal pipe which unites the two cylinders at the upper arms.

The motive power is produced in the following manner:—The two pumps constructed each in the peculiar manner represented in fig. 1, and before described, or with any modifications of which the same is practically susceptible, are placed in juxtaposition, as shown in fig. 2, as though they were to be worked by hand, or other extraneous force.

An oscillating beam W, is supported on a centre, *y*, and carries segments of toothed wheels, YY, which work into the toothed parts of the piston-rod, FF. At the extremities of the beam, WW, are segments of larger circles to the radii, *y*W. To each of these a chain, band, or rope is suspended, having an open box, $a^1 a$, fixed to the lower end of it.

Underneath the spouts GG, are placed stationary reservoirs, or open boxes, $b^1 b$, furnished at the part farthest from the spout with valves, $c^1 c$.

The reservoirs or boxes, $a^1 a$, have wheels or rollers fixed to them at each side, running in grooves, $d^1 d$. At the bottom of the sides nearest the pump is a valve, *ef*, opening outwards, having the hinge at e^1 and *e*.

The machine being thus disposed, is set in movement by pulling one of the cords or chains suspended at the extreme point of the beam WW, and thus raising one of the pistons and depressing the other by the action of the toothed segments, above described.

If the right-hand cord be pulled, the right-hand piston will be depressed, and forcing out the water at G, will fill the stationary reservoir, *b*. If, then, the left-hand cord is pulled, the left-hand piston will be depressed, and the second reservoir filled.

But when the last-mentioned moveable reservoir *a*, reaches the lowest point, the opposite one, *a*, arrives at the highest, whereupon the valve, *c*, being opened by the striking of the tappet, *g*, against the end of the lever, *i*, revolving about the fulcrum, *j*, with an iron rod attached to the valve, or by any other contrivance, the water escapes and continues to flow till it has filled the reservoir, *a*; as soon as that happens, it descends till it arrives at the lowest point, when the valve, *ef*, opens and lets out the water.

Meanwhile the opposite reservoir, a^1, has attained its highest point, and the valve, *i*, being opened in a similar way, the water gushes out and fills the reservoir, after which it descends by its own gravity, and the empty one, *a*, rises; a^1, is then emptied when it reaches the lowest point, and is filled in the way just described, and thus a continuous movement up and down is maintained by the alternate filling and emptying the two reservoirs.

The whole force arising from the weight of the water in the reservoirs, acting thus at the end of the lever YW, may be applied (less, of course, the friction,) as a motive power to any other machine; and if their contents be more than that of the cylinder, Z, Z, Z^1, Z^1, which the piston traverses, there will be a surplus of water besides.

The rollers of the moveable reservoir, on the side nearest the pump, are either separated or united together at each side of the upper part.

The valve of the moveable reservoirs is kept closed by means of two rollers running along the raised edge or side of the grooves, in which the rollers of the reservoirs run, or on the side of other grooves in the same plane; and at the extreme point to which the reservoir descends, an opening is made, by means of which they may be thrust out by the weight of the water pressing against the valve, and allow this last to open.

The reservoir, with its rollers, is represented in fig. 3, in which the upper rollers appear united as in the modification above described.

The way in which the opening of the valve takes place is shown in figs. 4, and 5.

At a short distance above A, the lowest point reached by the reservoir in descending, as at C in the figure, the side of the groove terminates, and the wood is cut away in a sloping direction, CJ. From a certain distance, B, down to A, an iron bar is placed on the same plane as the edge CM, and of the same width; this bar is united to the upright HI, in such sort as not to impede the passage of these last rollers or of those attached to the reservoir; the space between B and C is filled up by a bit of wood or metal D, fixed to a bar centred on the point S, and out of the reach of the path of the reservoir.

As long as the reservoir descends, the part, D, remains in its place, and the roller runs over it, and thence over the bar, BA, as though the side of the groove had been entire down to *a*, as in fig. 4; when it arrives at this point, having nothing to keep it level, it is thrown out by the pressure of the water to the level of HJ, and the valve opened.

On the ascent of the reservoir, the valve-rollers run up the bar, BA, on the plane, HJ, till they arrive at J, whence they run up the incline, TC, displacing the part, D, which turns upon S, as shown in fig. 5, and when they arrive at, CD, returns to its place, which the rollers running up, CM, prevent the valves from opening.

In order to prevent the reservoir from ascending until it is entirely emptied, a lever, *l k m*, as in fig. 2, is placed a little below the bottom of its course, with a funnel over the end of the longer arm, and a weight at the short end, *f*, just sufficient to counterpoise the funnel. A bar *n o a*, is united at the lever-end to another *o p q*, above the reservoir. It is moveable about each of the points, *a* and *o*, and lastly the bar *o p q*, turns about *p*, which is fixed. The water escaping from the reservoir falls upon the funnel, and weighing thus upon the end of the lever *m*, before it issues from the funnel, forces it down, raising at the same time the bars, *n o* and *o p q*, so that the end of this last pressing upon the roller of the reservoir prevents it from ascending until the water ceases to fall upon the end, *m*, of the lever.

The same contrivance may be adopted for the reservoir which is being filled, and it will be obvious that the centre of the bar, *n o*, may be placed on the other side of the fulcrum, *k*, in which case the fulcrum of *o p q*, must be at *o* instead of *p*.

MISCHIEVOUS EFFECTS OF PREMIUMS.—ROYAL AGRICULTURAL SOCIETY'S PRIZES FOR PORTABLE STEAM ENGINES.

Sir,—In 1847, the award of prizes by the officials of the Royal Agricultural Society of England, at their meeting in Northampton, was the subject of severe and deserved animadversion in your Magazine.* At that time, Mr. Josiah Parkes was the Society's consulting engineer, but he has since been superseded by Messrs. Easton and Amos, who acted as the professional advisers of the Society upon the occasion of their late meeting at Norwich. These gentlemen have long been well known in the engineering world, and might have been considered good judges of all mechanical matters. At any rate, whatever difficulties they might have discovered in dealing with the delicate differences of *drills*, or in cleverly calculating the capabilities of curious *cultivators*—however much they might have been perplexed with the puzzling peculiarities of *ploughs*, or hallucinated by the harassing hardships of *harrows*—although they might have proved remiss in reckoning up the recondite remarkabilities of *rakes*, or in scrutinising the subtilties of *scarifiers*—no person would have thought they could have been at fault in selecting the salient superiorities of *steam engines*. And yet, the award of the steam engine prizes (at Norwich) has again given very general and extensive dissatisfaction.

The extensive and increasing employment of steam power by agriculturists, has given great importance to this subject, and induced numerous manufacturers to turn their attention to the production of steam engines, in which portability, simplicity, durability, and economy of fuel should be combined with the other requisites for farming purposes. The demand thus created, and the efforts made to supply it, are strikingly shown by the fact of *eighteen* portable steam engines having been exhibited at the Norwich meeting,* besides which, others were excluded by informality in the entry.

The following tabular particulars of those exhibited are compiled from the Royal Society's catalogue:—

[See page 607.]

Upon the face of these data, it would seem evident that the two prize engines should have changed places, and such is the opinion of most persons conversant with the facts of the question. The engine of Messrs. Ransomes and May attracted much attention at the meeting, as well from its general excellence as from its having the novel property of locomobility. This engine threatening to prove a formidable competitor, was got

* Vol. xlvii., pages 114 and 187.

* The increasing demand for steam engines among agriculturists is also shown by the fact, that at Messrs. Clayton, Shuttleworth, and Co.'s works at Lincoln, the average yearly production of portable steam engines for agricultural purposes is *three per week*.

Names of Exhibitors.	Horses power.	Description of boiler.	Diameter of cylinder in inches.	Stroke in inches.	Revolutions of crank-shaft per minute.	Diameter of fly-wheel.	Weight of fly-wheel.	Pressure in lbs. per inch.	Time required to raise the steam to working pressure from water at 60°.	Fuel required for ditto, ditto.	Consumption of fuel per hour.	Price.
						ft. in.	cwt. qrs. lbs.	lbs.	* minutes.	* lbs.	* lbs.	£.
Clayton, Shuttleworth and Co.. ..	5	Tubular.	7	12	115	4 8	4 0 0	45	45	50	50	168
Ditto†	7	Ditto.	8½	12	115	5 0	4 0 0	45	40	50	70	209
Ditto	9	Ditto.	2—7	12	115	5 0	5 0 0	45	50	60	85	240
C. Burrell	4	Ditto.	8	13	110	5 6	5 0 0	...	45	60	50	180
G. Howe	6	Cylindrical	8	18	80	6 0	5 1 14	45	50	100	41	250
W. C. Cambridge	4	......	...	...	...	...	10 0 0	...	...	...	...	152
R. Hornsby	6	Tubular.	10½	12	110	6 0	7 0 0	...	60	84	50	264
Roe and Hanson	4	Ditto.	7	18	55	5 6	8 0 0	...	40	30	30	180
J. Smith	5	Ditto.	2—4½	14	100	...	......	...	60	84	56	175
Garrett and Sons.	6	Flues.	8¾	16	100	6 0	6 2 1	40	60	80	42	220
Ditto‡	6	Tubular.	8¾	16	100	6 0	6 2 1	40	60	100	38	250
J. and E. Headley	6	Ditto.	5	14	150	1—4ft.	......	...	45	84	56	220
Taylor and Dean	6	Ditto.	2—5½	17	100	6 6	3 2 0 each.	40	...	80	45	160
I. Ferrabie and Sons	6	Ditto.	10	15	100	6 6	8 0 0	35	50	85	75	220
T. and C. Garrood	4	Vertical.	...	...	...	...	......	40	...	...	...	140
Hurwood and Turner	6	Tubular.	7	14	110	2—6ft.	6 0 0 each.	...	40	70	39	240
W. N. Nicholson	6	Ditto.	10½	14	120	2—6ft.	3 2 0 each.	35	50	90	60	210
Ransomes and May	7	Ditto.	1—6½	10	90	2—4ft.	......	45	40	42	70	250

* These particulars are in many instances suppositions, no trials having been made at the time they were furnished.

† To this engine the second prize (£25) was awarded.

‡ To this engine the prize of £50 was awarded.

rid of by a trick. The engine was designed to burn *coke* only; at the trial, the judges compelled *coal* to be used. The highest prize was ultimately awarded to the six-horse power engine said to be "improved and manufactured," by Messrs. Garrett and Sons. Rumour having thrown considerable doubt upon the fact of this engine being really the production of the "Leiston Works," previous to the adjudication, the question was put to Mr. Garrett, who answered, "upon his honour," in the affirmative. Subsequent inquiry, however, confirmed the suspicions, that these engines were not "home made,"—and an intimation was given to the Society of the fraud that had been practised upon them.

Pending the probability of the Society taking any steps in the matter, I forbore to make mention of the circumstances; but further delicacy is rendered needless by the appearance of the following letter, in the *London Letter Bag* of Nov. 10th, addressed—

To the Right Honourable the Earl of Chichester, President of the Royal Agricultural Society of England.

My Lord,—I have before me the printed programme of the annual meeting of your Society, held at Norwich in July last, the

awards of prizes upon that occasion, and divers other documents referring to the proceedings there, and the general conduct of your Society. Your Lordship will agree with me, that the usefulness of a public Society is contingent upon its possession of public confidence; and that, in the case of a Society which seeks to encourage the scientific development of industry by awarding pecuniary or other prizes in recognition of superior merit, nothing can be of greater importance than the *integrity* with which its decisions are formed, and the *impartiality* with which its prizes are distributed. I deeply regret the occasion which has required my intervention; but that regret is considerably qualified by the reflection that your Lordship, with the Trustees, Vice-presidents, and Council of the Society, will not fail to perceive the paramount necessity of an immediate and full inquiry into the subject to which I am about to call your attention, as affecting the character and endangering the existence of your valuable body.

"The encouragement of men of science in their attention to the improvement of agricultural implements" is one of your published "objects."

Among the prizes awarded at Norwich, was one of 50*l*., "For the best portable steam-engine, applicable to thrashing, or other agricultural purposes."

This prize of 50*l*., was awarded to Messrs. Richard Garrett and Sons, of Leiston Works, Saxmundham, in Suffolk—as were several other prizes.

The award was made at the instance of your CONSULTING ENGINEERS, Messrs. Easton and Amos, of London.

With the exception of the boiler and the fly-wheel, the engine for which Messrs. Garrett obtained this, the highest prize, and the only 50*l*. prize, was manufactured by Messrs. Easton and Amos, of London, the consulting engineers of the Society, upon whose judgment the award was made!

Can anything more derogatory to the character of the Royal Agricultural Society of England be imagined?

Can anything more unfair to the candidates, more destructive of public confidence, or more detrimental to the best interests of the Society be conceived?

Your Lordship is not answerable for this abominable abuse of your confidence. The Society is not to be prejudiced by acts to which they were not parties. The council will see the absolute necessity for inquiry; and if, in matters of science and engineering skill, the judges require the guidance of professional men, the most efficacious measures for preventing a repetition of this unjust appropriation of your funds by your officials must and will be adopted.

JAMES ACLAND.

83, Upper Thames-street, London.

In the printed list of prizes, published and distributed at the meeting in question, the *award* of the steam-engine prizes appeared *blank*.

More striking illustrations of the American theory of "the mischievous effects of premiums,"* could hardly be found, than those so repeatedly furnished by the proceedings of the Royal Agricultural Society of England. Unless this truly importunate Institution can secure the assistance of judges of *integrity*, as well as of *skill*—of *impartiality*, as well as *talent*, the giving away of prizes will become a practice "more honoured in the breach than the observance."

I am, Sir, yours, &c.,
WILLIAM BADDELEY.

29, Alfred-street, Islington,
December 19, 1849.

GLYPHOGRAPHY.

Sir,—In the *Mechanics' Magazine* for November 17, 1849, there is contained an account from one of your contributors of a new method of electrotyping. The writer there first describes a part of Mr. Edward Palmer's patent Glyphography,* with these disadvantages: First; that he uses a plain copper plate, while we use a black one—that he proposes a black ground, while we use a white ground, so that when a line is drawn through the white ground, the black plate shows the line like an ink or pencil line, enabling the artist to see at once much of his effect. Your correspondent depends upon the composition for obtaining a sufficient depth for printing from, thus hampering or entirely preventing the freedom of hand necessary to works of art. We use a very thin ground, and depend upon an after process to give what depth we please, either for the hand or steam press. But the thinnest white ground that we could possibly use, so hampered the artist, that very few would use it;

* Vol. xlvii., p. 65.

* I do not mean to say that your correspondent has copied Mr. Palmer's invention, and sent it for his own; it is quite possible that he may have hit upon the idea himself, it being so obvious a thought, that it has been suggested to me by several persons.

all asked for the common etching ground, upon which, as is well known, the choicest work is done. Thus, from the experience of thousands of blocks passing through our hands, and personal intercourse with most of the leading artists in our line, we were obliged to throw aside even the thinnest white ground, and to introduce the ordinary etching ground. (That this is the case, our circular issued at the time, and which, together with several other specimens, I inclose, will abundantly prove;) so that now we can do all kinds of *fac-simile* work or *etchings* for the *surface press*. Our maps and writing we engrave, and so, in fact, obtain copper-plate engraving at the *surface press*.

Next, as regards the batteries and electrotyping, your correspondent says that the rotary magnet is better omitted for small things. Now, as regards blocks for books, and also electrotyping from wood blocks, of which we do a great number, the majority of them are small; these, instead of taking a *fortnight*, we do in *two days* by the aid of "Mr. Smee's very inefficient batteries," many of which we have had in constant use for these ten years; and surely the practical value of a battery should be judged of by its consumption of zinc, acid, &c., as well as by the quantity of electricity furnished. As to the use of the rotary magnet where the pole is very large, it seems to me quite worth experimenting upon, as by the use of the induced current to be obtained from the coil, larger depositions might be secured; and I should also suppose that many other interesting results might be obtained. But it is one thing to make a model, or to produce some one or more unique or curious works of art, the result of careful and even tedious or laborious experiment, and another thing to make a business of the same. For instance, if any one will call at my office, I shall be happy to show him a surface block in copper, of good and suitable depth for printing; the same obtained from a China ink drawing, done with a pen; but I should be very sorry to have to do a number of them.

I am, Sir, yours, &c.,

ABDIEL HAWKINS.

Glyphographic Office. 79, Shoe lane, December 14, 1849.

ON MULTIPLE ALGEBRA; AND ON TESSARINES. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

Sir,—The acknowledged advantage of distinct scientific nomenclature must be my excuse for troubling you with the following short attempt at a classification of systems of Multiple Algebra. Although in terms confined to Quadruple Systems, the accompanying remarks are, with the necessary and obvious extensions, applicable to all multiple systems.

I am, Sir, yours, &c.,

JAMES COCKLE.

2, Pump-Court, Temple, December 15, 1849.

When all powers of the imaginaries higher than the first are capable of being expressed, either by real quantities, or by linear functions of the imaginaries, we have a *quadratic* system. And, if we adopt the notation of my last paper (*vide supra*, pp. 557—8), we have

$$a^2 = a + ab + \beta c + \gamma d,$$

as the most general manner in which the square of an imaginary can be expressed. According to the form taken in different cases by the above expression, I propose to divide the systems into two groups, and to give to those groups the respective names of *ordinary* and *extraordinary*. The extraordinary systems may again be separated into two classes—*regular* and *irregular*.

The Ordinary Systems.

Under this head I propose to class those systems in which the square of each of the imaginaries is a real quantity, positive, negative, or zero. The more prominent of these systems are the Quaternion, Tessarine, Coquaternion, and Cotessarine; the first and third of which are *abnormal*, and the second and fourth *normal*.

The Extraordinary Systems.

Of these systems, which would appear in general to be very intractable, some which I propose to call the *regular* systems seem, on the ground of symmetry, to present facilities superior to the others, which I would denominate *irregular*.

1. THE REGULAR SYSTEMS. These systems are those in which the square of a takes the form

$$a + ab + (\beta + \gamma)c,$$

and in which β^2 is obtained from the above by interchanging α and β; and γ^2 by interchanging α and γ.

When $b=c$, the squares of all the imaginaries are identical. When $a=0$, and $b=0$, we have

$$\alpha^2=(\beta+\gamma)c, \beta^2=(\alpha+\gamma)c,$$

and $$\gamma^2=(\alpha+\beta)c;$$

and when $c=\pm 1$, we have probably the simplest of the *regular* systems. In the regular systems the real quantities involved in each of the expressions for the squares are identical.

2. THE IRREGULAR SYSTEMS are those in which the expressions for the squares of the imaginaries do not all involve the same real quantities. Perhaps the least intractable of the irregular systems is that in which

$$\alpha^2=\pm(\beta+\gamma), \beta^2=\mp(\alpha+\gamma),$$

and

$$\gamma^2=\pm(\alpha+\beta);$$

and the corresponding systems formed by varying the positions of the signs above given.

If we use the terms regular and irregular in reference to the *ordinary* systems, the Quaternion and Cotessarine systems are *regular*, the Tessarine and Coquaternion are *irregular*.

On Tessarines.

Let M be the true modulus of a Tessarine, then (*Mechanics' Magazine*, vol. l., p. 534),

$$M^2=(w\pm y)^2+(x\pm z)^2 \ldots . (a.)$$

Suppose that

$$w=Ms, \quad x=Mt,$$
$$y=Mu, \text{ and } z=Mv;$$

substitute these values for w, x, y, z, in equation (a.), and divide both sides of the result by M^2. We shall have

$$1=(s\pm u)^2+(t\pm v)^2$$

as the result. Now, since s, t, u, v, are all *real*, we may consider the last equation as identical with

$$1=(cos. p)^2+(sin. p)^2,$$

and we may suppose that

$$s\pm u=cos. p, \text{ and } t\pm v=sin. p.$$

Let

$s=q\ cos.\ p$; then $u=\pm(1-q)\ cos.\ p$.

So, if

$t=r\ sin.\ p$; then $v=\pm(1-r)\ sin.\ p$.

Hence we see that in place of the constituents w, x, y, z, of a tessarine we may introduce four new quantities, M, p, q, and r, between which and the old there exists besides the relation (a.) the following, viz.,

$$w=Mq\ cos.\ p,\ x=Mr\ sin.\ p,$$
$$y=\pm M(1-q)cos.\ p, z=\pm M(1-r)\ sin.\ p.$$

It is, however, easy to see that the last four equations involve the condition (a.). We now see that a tessarine may be put under the following form:

$$M\left\{q\ cos.\ p+i'r\ sin.\ p\pm j'(1-q)\ cos.\ p\pm k'(1-r)\ sin.\ p\right\}$$

where i', j', k', are the tessarine imaginaries.

In connection with this part of the subject, the reader may refer to my paper "On the Tessarine Algebra," published at pp. 558—9, of vol. l. of this work.

I may add that, in the above equation (a.), although we may change the signs of w and x, as well as of y and z, yet we shall not by that means increase the number of values of the tessarine modulus—which are *four* only.

JAMES COCKLE.

Postscript.—I presume that the b^3 which occurs in the co-efficient of x, in the first line of page 57 of the *Diary* for 1850, is a misprint for b^4.

Second Postscript.—The double sign which occurs in the above expression for a tessarine is connected with the signs which occur in the modulus.

REPLY TO MR. COCKLE'S QUERY (SUPRA, P. 557,). BY DR. BURNS, OF ROCHESTER.

Sir,—In reply to Mr. Cockle's query contained in No. 1375 of the *Mechanics' Magazine*, I have merely to state that by transposing the last term of his equation it becomes

$$x^5+ax^3+bx^2+\frac{b^2}{a}x+\left(\frac{b}{a}\right)^5=\left(\frac{a^2}{5b}\right)^5,$$

and the right-hand side being the fifth power of $\frac{a^2}{5b}$, I inferred that the left must also be the fifth power of

$$x+\frac{b}{a}, \text{ hence } x-\frac{a^3-5b^2}{5ab}=0,$$

and on trial found that this divisor depressed the equation to a biquadratic.

I am, Sir, your obedient servant,

WILLIAM BURNS.

Newton-terrace, Rochester, December 19, 1849.

ADVANTAGES DERIVABLE FROM HIGH PRESSURE STEAM.

The Lords of the Admiralty some time ago proposed to several of the leading Steam Engine Manufacturing houses the following questions:—

Quest. 1. What is the highest pressure you have in any case put upon steam boilers of your own construction?

Quest. 2. What is your opinion of the advantages in regard to power, economy, weight, space, &c., of introducing steam of greater pressure than that now commonly used in marine boilers?

Quest 3. To what extent, and with what precautions are you prepared to recommend an increase of pressure, due regard being had to the safety and durability of boiler and machinery?

Messrs. Seaward and Capel have published, in a pamphlet form, the letter which they sent in to the Admiralty in reply to these questions. To clear the way to an impartial consideration of the points submitted to them, they give the following retrospective sketch of the progress hitherto made in the application of steam power to the Royal Marine Service:

It is necessary to premise that, within the last few years, a very marked change has taken place in the mode of working steam engines employed in navigation; formerly the most eminent engineers were content to employ steam of an expansive force of not more than about four or five pounds per square inch above the pressure of the atmosphere; that is, with the aid of the vacuum, making a positive pressure of about 20 lbs. to the square inch; and it was then usual to cut off, or arrest the flow of the steam when the piston had travelled about two-thirds, or three-fourths of its range; but at the present day it is quite common to employ steam of the expansive force of 10 to 12 lbs. pressure, and in many instances as much as 15, 20, and 25 lbs. pressure, above the atmosphere; that is to say, steam of a positive pressure of from 25 to 40 lbs. per square inch; furthermore, it is now usual to cut off the flow of steam at a much earlier part of the stroke; that is to say, when the piston has travelled only three-fifths, or one-half, or only two-fifths, of its range.

It is an undoubted fact, that since the introduction of the new system of working the marine steam engine, there has taken place a remarkable augmentation in the speed of steam vessels, compared with former days; many persons noticing this fact, have hastily concluded that this increased speed is mainly, if not wholly, attributable to the introduction of the high elastic steam and greater expansion; this opinion, however, is by no means well founded: many circumstances have conspired to give the increased speed now noticed in steam vessels. In the first place, within the last few years, steam vessels have been built of much finer and lighter construction, with sharp bows, and every way better adapted for cutting through the water; secondly, an immense improvement has taken place in the construction of the machinery; better materials and workmanship; better proportion of parts, &c.; a remarkable saving of weight and space by the introduction of the direct-action engine and tubular boiler; and, lastly, a far better adaptation of the machinery to the form, capacity, and other qualities of the vessel: all these circumstances have conspired wonderfully in bringing about the increased velocity of the present race of steam vessels. At the same time, there is no question that the introduction of high elastic steam and greater expansion, have also contributed to the important result.

But, besides the increased velocity of the steam vessels of the present day, we have to advert to another interesting fact—the great reduction in the consumption of fuel in the present engines, compared with the old system; a great part of this very important result is, no doubt, to be attributed to the superior qualities of the machinery, as before referred to, and to the more perfect qualities of the present steam generators; but it is also certain that much of the beneficial result is also due to the present more extended use of the expansion principle. It therefore appears that the introduction of the new system of working the marine engine has been accompanied by two important results; one is the increased speed of steam vessels, the other a greater economy in the consumption of fuel, for producing a given power. Now, to ascertain, with tolerable exactness, to what extent the above two important benefits are attributable to the high elastic steam, and to the expansive principle respectively, is an inquiry of great moment; in fact, it involves the solution of the three questions which have been propounded to us respecting the use of high pressure steam in Her Majesty's steam navy.

Messrs. Seaward and Capel admit that the extended use of the expansive principle in working steam engines has been productive of considerable advantage; but they think at the same time that "the real advantages of the system have been by many persons greatly overrated." They go into a full investigation of these

advantages, and arrive at the following general conclusions:

There is no doubt that the expansion principle can be and is carried out to a much more beneficial extent in land engines (particularly those employed in draining mines), than can be applied to the marine engine; and many persons observing the very extended use of the system in the pumping engine are seduced into the belief that the system may be employed to the same extent, and with the same advantages, in the marine engine; nothing, however, can be more erroneous than this opinion; the conditions of the two engines are altogether different. In the first place the pumping engine is not trammelled by a rotary motion; the consequence is, that when a quantity of high elastic steam is emitted into the cylinder of this kind of engine, a very great initial velocity is given to the piston, and a great momentum is given to a large mass of matter,—a mass of matter generally eight to ten times greater than in a marine engine of the same power: whereas, in the marine engine the initial velocity of the piston is very small;—it does not acquire its maximum velocity (when the steam is cut off at a sixth) until the steam becomes reduced to one-third of its force. Secondly, in the pumping engine there is no necessary limitation of space and weight: whereas, in the marine engine the circumstances of space and weight are of the greatest consequence.

. . . .

When the new mode of working has been carried out to the fullest extent, there never had been an instance that we know of, nor is there any apparent likelihood of its occurring for some time, that in a marine engine the steam can be, in practice, advantageously cut off at a sixth part of the stroke; because, to do so, supposing that in each case the same amount of available power be required, it would be imperative to work with steam of three times the pressure, *i. e.*, of 60 lbs. positive pressure, and to make the machinery three times as strong; consequently, about twice or three times the weight;—a condition of things which, if taken into consideration with the increased cost of the engines, and the increased wear, would go far to outweigh the economy of saving half the fuel; indeed, with such an enormous addition to the weight of the machinery, the vessel could carry little or no fuel at all.

To state explicitly what is the exact rate of expansion which it would be advisable to adopt in marine engines is rather a difficult problem, the solution of which depends upon many contingent and varying circumstances. If it is required to give a steam vessel the greatest possible speed, without regarding strict economy in fuel, then the principle of expansion can be carried out only to a limited extent; but if it is required to adapt machinery to a vessel, to enable her to make a voyage to the greatest distance with a given quantity of fuel (without regarding the actual speed of the vessel, or the time occupied on the voyage), then no doubt the principle of expansion may be carried out to a much greater extent. We have considered the subject very carefully for a long time past, and it is our opinion that to meet, what may be considered the more important exigencies of the British steam marine, it is desirable, when a larger power is employed (four or five horses power), to adopt the machinery so that the steam be cut off, in general working, at about one-half or three-fifths of the stroke; and in engines of smaller power, at about three-fifths to three-fourths of the stroke; we think, with these rates of expansion, the greatest amount of available benefit will be obtained, with the smallest amount of practical inconveniences. We think the above is the best for the general mode of working the marine engines in the service; at the same time, in order to meet particular emergencies, the engines should be so contrived that the rate of expansion may be varied to a considerable extent.

The elastic force of steam most suitable for steam navigation is next discussed:

For the more convenient elucidation of this matter, we will draw a comparison between two engines, one working with steam of 20 lbs. positive pressure, and the other working with steam of 40 lbs. positive pressure; these being, we believe, about the extreme limits at which steam is and has been employed for some time past in marine engines of the best character.

Let us imagine that the two steam-engines be made exactly alike in every particular,—of the same strength and proportion of parts,—of the same length of stroke,—with the same condensing apparatus, and the same size and form of boiler; but with this difference, that one engine shall have an area of piston of 3000 square inches, and shall work with steam of 20 lbs. positive pressure, and which, for distinction, we will call the 20 lbs. engine; while the other shall have an area of piston of only 1500 square inches (that is exactly the half), but working with steam of double the pressure, that is of 40 lbs. positive pressure, and which we will therefore call the 40 lbs. engine; and we will further suppose that the steam is cut off at half-stroke in both engines. Now,

we venture to affirm that the actual amount of force exerted by the steam in these two engines will be precisely the same; it is clear there can be no difference, because the 20 lbs. steam in the larger cylinder, will be quite equivalent to the 40 lbs. steam in the smaller cylinder. But we have to consider what will be the amount of available power given out respectively by the two engines; and to estimate this we must ascertain what is the sum of the retarding forces in the two engines respectively. We have already observed that the two most important items of the retarding forces are friction, and the imperfection of the vacuum; to these may be added the loss by radiation of heat in the cylinder, and the power required to pump the feed-water back into the boiler;—and, first of the friction, the amount of retarding force caused by friction will be nearly the same in the two engines, though perhaps rather more in the 40 lbs. engine than in the other; for, although the 40 lbs. engine has a less circumference of cylinder, yet, as the steam is double the elastic force, it will be requisite to secure the packing of the piston proportionately tighter and harder to prevent escape of steam; again, the friction of the slides will, in proportion to the size, be double in the 40 lbs. engine that it will be in the roll-engine; upon the whole we may safely affirm that the amount of friction will not be greater, if so great, in the latter as in the 40 lbs. engine. Secondly, as to the retardation caused by the imperfect vacuum, in this particular, there is no question that the amount of loss is much greater (double) in the 20 lbs. engine than in the 40 lbs. engine; the amount of retarding force, by imperfect vacuum in the 20 lbs. engine, may be estimated at about 1½ lbs. per square inch on the piston (equal to 3 inches of mercury), that is, equal to three-fortieths of the pressure of the steam, or 7½ per cent.; but in the 40 lbs. engine the amount of this retarding force is also 1½ lbs. on the square inch of the piston, that is, three-eightieths of the pressure of the steam, or 3¾ per cent. only; therefore there is manifestly an advantage of about 3¾ per cent. in favour of the 40 lbs. engine. Thirdly, as regards the loss by radiation of heat from the cylinder; we consider it will be nearly the same in both engines, for, although there is a greater surface of cylinder in the 20 lbs. engine, yet the temperature of the steam is so much higher in the 40 lbs. cylinder, that the radiation will be proportionately more rapid; therefore we may very safely assume that, as regards the cylinder, radiation of heat will be quite as great in the 40 lbs. engine as in the 20 lbs. engine; but, as regards the radiation from the boilers, there will be, in the two cases, a considerable difference; because the two boilers are supposed to be alike in form, size, and arrangement of parts (whatever kind of boiler is sufficient to raise steam for the 40 lbs. engine will be ample to raise steam for the 20 lbs. engine); but as in the one case there will be a considerable increase of temperature, of about 40 degrees, there necessarily will be a much greater radiation of heat from that boiler: it is impossible to state, with anything like precision, what will be the actual difference, but it may be safely estimated at about 1 per cent. in favour of the 20 lbs. engine. Fourthly, the abstraction of power in pumping the feed-water back into the boiler; the power required for this purpose in the 20 lbs. engine is equal to 1 per cent. on the whole power exerted by the steam; but in the 40 lbs. engine, the amount of this retarding force is clearly double—that is, 2 per cent. of the force of the steam; consequently, as regards this particular, there will be an advantage of 1 per cent. in favour of the 20 lbs. engine; therefore, as regards the imperfection of the vacuum, there will be an advantage of 3¾ per cent. in favour of the 40 lbs. engine; while, in reference to the returning the feed-water back to the boiler, there will be an advantage of 1 per cent. in favour of the 20 lbs. engine, and another 1 per cent. from the smaller quantity of heat radiated from the boiler—the other retarding forces being equal on the two engines; there results, therefore, a benefit of 1¾ per cent. in favour of the 40 lbs. engine. But we have already remarked, that when a measure of steam is expanded to double its volume, a sensible loss in the power of the expanded steam takes place in consequence of the absorption of caloric. Now, when a measure of steam is compressed to half its volume, a phenomenon of an analogous character takes place, though in an opposite direction: the compressed steam, instead of being exactly double the pressure of the original steam, will, in fact, be considerably more than double, in consequence of the giving out of a certain quantity of caloric; so that, while a measure of 20 lbs. steam loses 5½ per cent. of its force by being expanded into two volumes, it will also give an increase of 5½ per cent. in the force by being compressed into half its volume; but a gain in force is, in this case, equivalent to an economy in the combustion of the fuel; that is to say, one cubic foot of steam, of 40 lbs. pressure, can be generated with less fuel, by 5½ per cent, than 2 feet of 20 lbs. steam; there is, therefore, a manifest gain of 5½ per cent. in generating steam of 40 lbs. pressure as compared with the production of

steam of 20 lbs. pressure. If we add this gain of 5¼ per cent. to the 1¾ per cent. obtained by the difference in the retarding forces, &c., this will make a total benefit or economy on the side of the 40 lbs. steam; that is to say, if the two engines give the same quantity of power, and are worked under precisely the same conditions, the 40 lbs. engine will be worked with a manifest saving of 7½ per cent. in the fuel as compared with the 20lbs. engine.

And if we suppose a third engine exactly like the other, but having an area of cylinder of only 750 inches (only one-quarter of the 20 lbs. engine), but working with steam of 80 lbs. positive pressure, then the available power will still be the same; but there will, in this case, be a saving in the fuel of 12 per cent.; for, in the first place, the loss of power through the imperfection of vacuum will, in this engine, be only one-fourth of the loss in the 20lbs. engine (*i. e.*, one-fourth of 7½ per cent., not quite 2 per cent.), leaving a gain of 5½ per cent. in favour of the 80 lbs. engine. In the next place there will be an economy in generating the steam for the 80 lbs. engine of 11½ per cent. over that for the 20 lbs. engine; for the economy in generating the 80 lbs. steam will be equal in amount to the loss that would arise by expanding steam four times, as already shown; there will, therefore, be, from these two sources, a benefit of 17 per cent. in favour of the 80 lbs. engine; but, on the other hand, the power abstracted for returning the feed-water into the 80 lbs. boiler is fourfold that of the 20 lbs. boiler; therefore, there will be a loss in the former of 3 per cent; again, there will be a loss of, at least, 2 per cent. in consequence of the greater radiation of heat in the 80 lbs. boiler; deducting the loss occasioned by these two causes from the 17 per cent., there remains 12 per cent., which is the full amount of economy in fuel resulting from the employ of the 80 lbs. engine over the 20lbs. engine. But there will also be this advantage, that the cylinder of the 80 lbs. engine will be only half the diameter of that of the 20lbs. engine—the available power of both engines being exactly the same.*

We have assumed that the two engines are to be exactly the same in every respect, all but the area of the cylinder,—the length of stroke, the size, proportion, and strength of parts, everywhere to be the same; consequently, the weight of the two engines will be the same: but when we come to the boiler, we shall find a necessity for making a considerable difference; for steam of 20 lbs. positive is the same as steam of 5 lbs. pressure above atmospheric pressure; and the boiler of the 20 lbs. engine will have to sustain an explosive force equal to 5 lbs. per square inch only; but steam of 40 lbs. positive pressure is equivalent to 25 lbs. above atmospheric pressure; therefore the boiler of the 40 lbs. engine will have to sustain an explosive force of 25 lbs. per square inch; that is, five times greater than the other. To insure equal safety, this boiler ought therefore to be made five times as strong as the other; but to make one boiler five times as strong as the other involves the necessity of a great addition of weight. To be in any way proportionable, it ought at least to be double, or three times, the weight, to insure the same positive amount of safety. The ordinary weight of a tubular boiler is about equal to one-fifth of the whole machinery; therefore, to make it double the weight, would increase the weight of the whole machinery at least 20 per cent., which becomes a very serious consideration; and without this addition of weight, the increase of danger becomes very formidable.

Again: the boiler of the 80 lb. engine will have to sustain an explosive force thirteen times greater than the 20 lbs. boiler. To make a boiler adequate to sustain so great a pressure, that shall have the same compactness, convenience, and facilities of working as the tubular boiler now employed for generating the steam of moderate force, and which shall present the same amount of positive security, and not materially differ in weight, is, we have no hesitation in declaring, totally impracticable by any means which engineers of the present day have at their command. Furthermore, it is important to remark, that although the wear and tear upon the machinery may be pretty nearly the same in all three of the engines offered for comparison, yet, as regards the wear and tear and deterioration of the boilers, it will be far greater in the 40 lbs. and 80 lbs. boilers than in the 20 lbs. boiler. The difference will be very considerable; indeed, so much as almost to outweigh the economy in the fuel.

On the other hand, to be obliged to employ a cylinder of double the capacity (double the area), which must be done with the 20 lbs. engine, is undoubtedly attended with some inconvenience;—the cylinder of the 40 lbs. engine is more compact, and offers less embarrassment in the general arrangement. To sum the whole matter in a few words, therefore, it may be safely affirmed that the advantage on the side of

* We have endeavoured to place the advantages of the high-pressure steam in the most favourable point of view that it is susceptible of; and we believe that we have stated the utmost that can be said in its favour.

the 20 lbs. engine is comparative safety; while in favour of the 40 lbs. engine there is compactness and a small economy of fuel; that is to say, it is "*safety versus convenience and a trifling economy.*" But it must be confessed, that the amount of convenience in the 40 lbs. engine is not of very great importance, while the amount of economy is but subordinate. The safety obtained on the other side is undoubtedly of great importance; it is, indeed, a matter of paramount consideration.

. . . .

From the small amount of advantage which we have shown to be derivable from the use of high-pressure steam, so small compared with the popular opinion on the subject, it may be thought that we entertain a sort of prejudice against high elastic steam; but such is not the case—we have no prejudice against high steam *per se*, but we do entertain a mortal repugnance agains incurring great danger without being able, in return, to secure an adequate benefit. If the danger to be apprehended were confined to the pecuniary loss occasioned by the breakage of a part of the machinery, or mere rupture of the boiler, it would be comparatively of small importance; but it is the personal hazard which is so much to be dreaded: a break down of any part of the mechanism of the engines is rarely attended by any injury to life or limb; but an explosion or collapse of a boiler is almost invariably productive of the most disastrous results.

There is no difficulty in making the mechanism of an engine sufficiently strong to sustain the pressure of steam of any elastic force whatever; and if we can succeed in discovering a mode of constructing a commodious steam generator of unquestionable safety, there can then be no valid objection whatever to the employing of steam of 40 or 50, or even 100 lbs. pressure, for marine purposes; on the contrary, there would be the inducement of a positive economy and considerable convenience in using such steam; but, until such steam generator is invented, we think it will be well to pause before making any considerable addition to the pressure of the steam employed in Her Majesty's service; for we hold it to be past all doubt that, for a confessedly small amount of advantage, we ought not to incur a probable or possible, much less a positive, risk of personal danger.

The letter concludes with the following explicit answers to the three questions put by the Admiralty:—

Answer to Question First.

The highest pressure of steam that we have in any case put upon a marine boiler of our own construction was about 16 lbs. to the square inch; but we are not inclined to repeat the experiment, as we feel assured that we can obtain equally good results with steam of a lower pressure: from 10 lbs. to 12 lbs. is the usual pressure we employ in the merchant service for engines and boilers of comparative small power.

To Question Second.

The steam pressure at present employed in the service is about 8 lbs. per square inch. We consider steam of this pressure to be well adapted for the exigencies of the service;—we believe it is calculated to secure all the important advantages of power, ecoe nomy of weight and space, in a very eminent degree;—these advantages will, in some respects, be slightly increased by augmenting the steam pressure to 10 or 12 lbs. to the square inch.

To Question Third.

We strongly recommend that the steam employed in the navy should not be of greater pressure than 10 lbs. per square inch, or, in extreme cases, 12 lbs. to the square inch;—any material increase to the latter pressure will be attended with considerable risk, without any adequate advantage.

CONTRACTING OF ELECTRIC WIRES.

Sir,—Reading in your Magazine of last week, No. 1376, page 585, a letter on the breaking of wires by contraction, in frosty weather, on the London and North-Western line of telegraph, I beg to suggest, that if each wire had a kind of spiral twist, at proper distances apart, it would expand or give way at those parts sufficiently to counteract the contraction of the metal. The proper distances would be easily determined by experiment or calculation.

I am, Sir, yours, &c.,

JOHN GILBERT.

79, Wardour-street, Soho, Dec. 24th, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 20TH OF DECEMBER, 1849.

HENRY MILLS STOWE, Bermuda, master of the brig "James." *For improvements in blocks and shears.* Patent dated June 20, 1849.

The first of these improvements consists in employing a metal fork which contains the block, and has a hole drilled in the

lower part of each leg, through which is passed the spindle on which the shear revolves. A second improvement consists in lapping a male screw on the bushing, which admits of its being screwed into the centre of the shear.

Claims.—1. The improvement in blocks, as described.

2. The improvement in shears, as described.

George Benjamin Thorneycroft, Wolverhampton, ironmaster. *For improvements in manufacturing railway tires, axles, and other iron where great strength and durability is* (query *are*) *required.* Patent dated June 26, 1849.

Claims.—1. Producing a tire, the outer part of which is of tough fibrous iron, and the inner part of crystallized homogeneous iron throughout.

2. Producing a semi-compound axle or bar of iron with the inner portion not perfectly united to the outer iron, in consesequence of its having being coated with fine clay or other plastic substance.

3. Producing an axle or bar of iron where great strength is required, by constructing the pile hollow, so that when rolled out to the desired size the centre parts shall be welded together.

Alexander Francis Campbell, Great Plumstead, Norfolk. *For improvements in wheels, ploughs and harrows, steam-boilers, and machinery for propelling.* Patent dated June 20, 1849.

The patentee describes and claims:

1. The constructing of carriage-wheels with tie rods between the spokes, and tires composed of hollow flexible tubes filled with water.

2. The application of a steering bar to the fore axle of a plough having either two fore wheels and one hind one, or one fore wheel and two hind—the employment of a draw-beam composed of two parts, united by a centre pin, the fore end of the upper part being attached to the fore axle, and connected by a sliding piece to the fore end of the other part which carries the coulter and share, whereby the depth of cut may be regulated as required,—a mode of constructing a plough whereby the share will be always maintained in a horizontal position when the fore axle is inclined;—the use of a third wheel, on the land side of the plough, for the purpose of supporting the share; and a new mode of constructing tension coulters and shares.

3. A mode of constructing harrows with suspension rods and straight axles for supporting the teeth carrying-frame from the wheel-frame, in order that a perfect parallelism between the two may be maintained.

4. A new mode of constructing steam boilers. The sides of the furnace are hollow, and filled with water (as well, also, as the fire bars), and communicate with each other and the boiler by means of transverse tubes, placed immediately under the bottom of the boiler. The back of the furnace is made hollow, through which the air flows, and is heated previous to flowing into the flues and thence to the chimney.

5. A new rotary propeller, which bears a strong family likeness to Beale's bird's-wing propeller; also the connecting of the pistons of the steam cylinder and air cylinder upon the same rod, when air is expelled from the latter and employed to propel the vessel; and the employment of lee boards, with or without rudders, to assist in propelling.

Thomas Merchant, Derby, Civil Engineer; and Robert Harland, Derby, carriage-builder. *For certain improvements in the construction of railway carriages.* Patent dated June 25, 1849.

This invention comprehends, 1. A mode of coupling carriages together; 2. A new drag; and, 3. A new construction of "mercantile carriage."

1. The draw-bar in front of the carriage is connected by two rods to the ends of two cross levers, which are centred on the same pin, while their other ends are connected in a similar manner to the draw-bar at the back of the carriage. The extreme ends of the levers are connected to the buffer-rods, so that, supposing a train of carriages linked together, and each with this arrangement applied, the buffers will be in constant contact with one another.

2. The "drag" is supported by a point on the rod, which connects the bearings of the wheels of the carriage.

3. The new "mercantile carriage" consists of an ordinary covered truck, with a portion of the top separated from the rest, and turning upon a pin, so that it may be slid on one side out of the way. (An obvious encroachment on Mr. Henson's domain. See *Mech. Mag.*, current vol., p. 577, also vol. xlix., p. 385.)

Claims.—1. The coupling of railway carriages and engines together in such manner that the buffers of the one shall be in contact with the buffers of the other.

2. The improved "drag," as described.

3. The improved mode of constructing "mercantile carriages," whereby the moveable part of the covers may be slid out of the way, but always in a horizontal plane.

William Wilson, jun., Campbellfield, Glasgow. *For improvements in cutting plastic tubes or tiles.* Patent dated June 27, 1849.

These improvements consist in employing hollow horses, supported in a hollow frame attached to a handle. Each horse carries inside a rod which takes into a slot in a bent lever, supported in a rotary circular plate, near the mouth of the horse, which carries the cutter; the other end of the rod takes into the hollow frame, and has a toothed wheel keyed upon it, which is in connection with other toothed and bevelled gearing, whereby it is made to revolve and travel to and fro within the horse; so that, when the tube or tile has been received upon the horse, the cutter is protruded beyond the mouth of it into the tube or tile, caused to make one revolution, and afterwards to return to its former position. It follows, from the preceding arrangement, that the edge of the tube upon the horse will be curved, and that from which it was cut concave, or *vice versâ*, according to the particular form of cutter employed.

Claim.—Arranging apparatus to cut tubes or tiles from each other, so that one of their ends may be concave or hollow, and the other convex to fit into the same.

R. A. Brooman, of the firm of Messrs. Robertson and Co., 166, Fleet-street, patent agents. *For certain improvements in apparatus for transferring liquids from one vessel to another, and for filling bottles and other vessels with liquids.* (Communicated from abroad.) Patent dated June 20, 1849.

We shall give a full description of this invention, with engravings, in an early Number. The "claim" is for the regulating of the transfer of liquids from one vessel to another by the means of the apparatus described; that is to say, in so far as regards a peculiar combination of valves, floats, levers, wings, and other contrivances, whereby the flow of the liquid from one vessel is stopped as soon as that in the receiving vessel reaches to any given height, without there being any loss of liquid attending the operation.

Charles James Coverly Griffin, of Southwark, hatter. *For certain improvements in military accoutrements.* (A communication.) Patent dated June 20, 1849.

The patentee very sensibly remarks, that "the scabbard of a sword, though useful as a means of protecting the blade when not in use, becomes an encumbrance and a hindrance the moment the sword is withdrawn for action." The object of the present invention, therefore, is to construct the scabbard so that when the weapon is drawn, the scabbard shall, by the action of drawing, be collapsed into so small a compass as to offer no impediment to the movements of the wearer, and shall be instantly expanded to its original length by the action of returning it to its place. Three modes of effecting this are described: The first (which seems to us the most feasible of the whole) consists in making the scabbard in parts sliding within one another, after the manner of a telescope; each part being provided with strings and catches upon which the blade acts, so as to draw and push the parts of the scabbard one within the other. The second is but a modification of the first. The third is dependent on magnetic agency—the sheath being made in two parts, the bottom of one of which is made of magnetised steel, and the top of the other of soft iron. When the blade is drawn out of the scabbard, it will, it is said, drag the lever part with it, by virtue of the powerful and instantaneous affinity of soft iron for the end.

Claim.—The making of the scabbards of swords and other like weapons in parts taking into one another, as exemplified.

Edward Lyon Berthon, of Fareham, clerk. *For an instrument to show the velocity of a ship or other vessel propelled through the water by wind or steam, or other moving power.* Patent dated June 20, 1849.

The present patent covers only one of a number of important inventions which Mr. Berthon has made for ascertaining the velocity, lee-way, trim, &c., of ships; and the others form the subject of a second patent, which remains yet to be specified. We shall therefore wait till both specifications are on the file, when we shall lay an account of the whole before our readers.

Henry Bessemer, of Baxter House, Old St. Pancras, engineer. *For improvements in the methods, means, and machinery or apparatus employed for raising and forcing water and other fluids.* Patent dated June 23, 1849.

The improvements embraced under this patent are classed under three distinct heads.

I. The first includes a new apparatus for raising and forcing water, called a centrifugal disc pump, and the modifications necessary for applying it—1, to forcing water; 2, to lifting; and 3, to both lifting and forcing.

We shall give, in a future Number, a full description of this pump, of the performances of which we have already received very flattering accounts. The principal novelties will be found indicated by the claims, which are in these words:—

1. I claim the centrifugal disc lifting pump, the centrifugal disc forcing pump, and the centrifugal disc lifting and forcing pump, and the several modifications thereof, each in the peculiar arrangement, combination, and adaptation of methods and means whereby the lifting or forcing, or lifting and

forcing, of the water, are effected by centrifugal agency, as described.

2. I claim generally the employment, in centrifugal disc pumps having rotating vanes, blades or leaves, of discs composed of two plates which approximate towards each other from the centre, but do not touch at their peripheries.

3. I claim generally the method of inclosing the revolving vanes, blades, or leaves of centrifugal pumps in close cases or chambers, having suction pipes and rising mains, as described.

4. I claim the application of the method adopted in the said centrifugal pumps of supporting the shafts in suitable bearings cast on or bolted to the rising main, to other hydraulic machines in which centrifugal force is obtained by means of rotating vanes, blades, or leaves.

5. I claim the employment generally, in centrifugal pumps in which revolving vanes, blades, or leaves are used, of vertical axles, as described.

6. I claim generally the method of supporting the shafts and discs of centrifugal pumps by the upward pressure of the column of water in the rising main, as exemplified and described.

7. I claim generally as regards centrifugal pumps having revolving vanes, blades, or leaves, the method of contracting the spaces at the ends of the said vanes, blades, or leaves, so that their aggregate area shall bear a smaller proportion to that of the centre inlet than it would do if the plates were kept parallel throughout.

II. The second branch of the specification describes several improved methods of connecting or combining first movers with the centrifugal pump, and also with other machines for raising and forcing water by centrifugal agency. The leading features of these methods may also be gathered from the claims made in relation to them, which are as follows:—

8. I claim the several modes of connecting or combining the said centrifugal disc pump, and the several modifications thereof with first movers, before exemplified and described.

9. I claim generally the employment in hydraulic machines in which centrifugal force is obtained by means of rotating vanes, blades, or leaves, of the method of making the shaft which gives motion to the said vanes, blades, or leaves, to serve also the purposes of a fly-wheel, as described.

10. I claim generally the direct application of wind sails to the axles of hydraulic machines acting by centrifugal force obtained by means of rotating vanes, blades, or leaves.

11. I claim the employment of the peculiar form of wind sails, before described, in all cases where wind is employed as a first mover of machinery or apparatus for raising or forcing water.

12. I claim generally the construction, for the purpose of raising and forcing water, of centrifugal pumps having rotating vanes, blades, or leaves, with emissive engines, as exemplified and described.

13. I claim the combination of the centrifugal disc pump with the disc steam engine, in the manner described.

14. I claim generally, for the purpose of forcing water of centrifugal pumps having rotating vanes, blades, or leaves with screw propellers, as exemplified and described.

15. I claim generally the employment, for the purpose of forcing water, of screw propellers having leaves with raised edges, as before described.

Mr. Bessemer mentions incidentally under this head a very excellent contrivance for lubricating those parts of hydraulic machinery which work under water:—

A mixture of oil and tallow, which is semi-fluid at the ordinary temperature of water, is forced into the grease-cup, and the plunger is then screwed down, which will force the grease along the pipe. The plunger may then be unscrewed, and another and another charge of grease forced in, in like manner; so that the journals of shafts working below or immersed in water may be always supplied with grease, and any small chambers in connection with them kept charged; while the semi-fluidity of the material will prevent the water from entering and displacing it. It will be found better rather to force too much grease down the pipe, and even to lose some by the sides of the shaft, than to allow any space to be occupied by water.

III. Mr. Bessemer describes, lastly, a peculiar method of raising or forcing water and other fluids "by the action of revolving blades placed in an inclined position round an axis, so as to form part of a spiral screw." This, in fact, resolves itself into a new method of screw propelling, which proposes too much merit to be dismissed with any general reference, and must therefore be reserved for a full exposition in a future Number. The claim in respect of it is to "the forcing of water by means of inclined blades attached to a common axis revolving within a tube or trunk, and having guide plates, as represented and described.

James Nasmyth, Patricroft, Manchester, engineer. *For certain improvements in the method of and apparatus for communicating and regulating the power for driving or working machines employed in manufactur-*

ing, dyeing, printing, and finishing textile fabrics. Patent dated June 26, 1849.

The patentee describes and claims,

A method of communicating and regulating the power for driving or working machines employed in manufacturing, dyeing, printing, and finishing textile fabrics, by the application of a distinct or separate steam engine to each separate machine or set of machines, and placing the handle of the lever of the valve which regulates the admission of steam to the cylinder, in a convenient position near the engine, in order that the workman charged with the superintendence of the machine may at the same time have perfect control over the engine which communicates the driving power without interfering with the adjacent engines.

CHRISTOPHER NICKELS, York-road, Lambeth. *For improvements in the manufacture of woollen and other fabrics.* Patent dated June 26, 1849.

1. Mr. Nickels proposes first to make the operations of cutting and weaving of cut-pile or looped fabrics, simultaneous, by employing a bar actuated by a cam on the driving shaft, and provided with two rows of hooks which are caused to enter the warp, take up and retain hold of the threads until several picks have been thrown into the shed, when a cutter having curved slots into which take projections from the bar, and thereby support it, is moved lengthwise by a similar cam arrangement, and consequently made to enter the hooks and cut the threads, whereby the hooks are liberated, and the operation allowed to be continued.

2. In manufacturing fabrics with a woven weft, it is proposed to make the weft with one rough edge and one selvage, and afterwards to weave it into the fabric with the selvage on one side of the fabric, and the rough edge on the other.

3. The rods or cords employed to produce the loop in terry or pile fabrics, are to be introduced transversely during the operation of weaving, and according as they are wanted, in the same way as threads of india-rubber are introduced in the manufacture of elastic fabrics, and afterwards drawn or cut out.

Claims.—1. The mode of manufacturing cut pile fabrics.

2. The method of producing woven fabrics with a woven weft.

3. The mode of manufacturing terry, or pile, or looped fabrics.

THOMAS WOOD GRAY, Limehouse, brass-founder. *For improvements in water-closets, pumps, cocks, lubricators, and deck-lights.* Patent dated June 26, 1849.

The patentee describes and claims,

1. A semi-spherical pump, which consists of a semi-spherical chamber, divided by a central partition into two compartments, with an induction valve in the bottom of each, which is closed at top by a cover furnished with two eduction valves. Within the chamber there is a valved flapper, which is worked by means of a lever attached thereto, and furnished at the end with a friction-roller, which takes into a slot in a long lever, whereby the whole is put into action.

2. A horizontal flapper pump, in which two flappers, having vulcanized india-rubber ends and sides, are worked over two induction ports by a crank and lever arrangement similar to the preceding.

3. A water-closet in which an arrangement, similar to the semi-spherical pump, is applied to discharge its contents.

4. A variety of valves and cocks, which it would be impossible to describe intelligibly without illustrative engravings.

5. A lubricator, in which the plunger is worked by a crank and lever.

6. A mode of fixing deck-lights, by placing the disc of glass in a metal frame which is made to screw in or out of another metal frame let into the deck.

SAMUEL COLT, Trafalgar-square, Middlesex, gentleman. *For improvements in fire-arms.* Patent dated June 20, 1849.

These improvements have relation to the "revolver" fire-arm, which formed the subject of a former patent, granted to the same gentleman, Oct. 22, 1825.

WILLIAM COMBAULD JACOB, of 5, Bread-street, in the City of London, warehouseman. *For improvements in the manufacture of parasols and umbrellas.* Patent dated June 20, 1849.

This invention consists in the application to the manufacture of umbrellas and parasols of a material or fabric not heretofore used for that purpose, which is produced by "shooting" a warp of cotton with a weft of silk or linen, or of silk and linen combined, or of silk and cotton, or by "shooting" a warp of linen with a weft of silk or linen, or of silk and linen, or of silk and cotton combined. If desired, the fabric may be figured, striped, or otherwise ornamented, by conducting the operation of weaving in a suitable manner to effect this object; or by introducing silk threads in the warp at those parts where the figure, stripe, or border is to be produced. In order that the material may be cut up without waste, it is to be manufactured in widths of twenty-two, twenty-four, and twenty-six inches for umbrellas, and of fourteen, sixteen, eighteen, and thirty-eight inches for parasols.

Claim.—The improvements in the manufacture of parasols and umbrellas by the

use of a material not heretofore used in covering of sticks or frames of umbrellas and parasols, in the manner at present adopted;—such material to be made by combining cotton or linen, to be used as warp, with silk or linen, or a combination of silk and linen, or silk and cotton, to be used as weft, with the introduction (necessary to make such covering figured, striped, or ornamented) into the warp of a sufficient number of silk threads to form such figure, stripe, or ornament.

Specifications due but not enrolled.

James Leadbetter, Kirby-Lonsdale, Westmoreland, brazier. *For certain improvements in the method of raising water and other fluids, which improvements are applicable to the propulsion of machinery, pumping of mines, and other similar purposes.* Patent dated June 26, 1849.

Walter Neilson, Hyde Park-street, Glasgow, engineer. *For improvements in the application of steam for raising, lowering, moving, or transporting heavy bodies.* Patent dated June 26th, 1849.

RECENT AMERICAN PATENTS.

(From the *Franklin Journal.*)

An Improved Lubricating Compound. *Alonzo S. Grenville.*

The patentee says,—"The object I have in view in using the straits or cod-liver oil, in connexion with either the sperm or lard oil, or both, and magnesia, is that it causes the magnesia to be held in suspension in the mixture of oils."

Claim.—"The combination of the straits oil with the magnesia and the sperm oil, lard oil, or a mixture of the two, or any oleaginous matter or matters possessing like powers of non-suspension, to make a very cheap and efficient anti-friction oil, to be applied to the lubrication of machinery."

For an Improved Detached Metallic Cartridge Tube, &c., for Fire-Arms. *David Minesinger.*

This invention consists in making the external surface of the metallic cartridge tube of the form of the frustum of a cone, and the internal surface cylindrical, which causes the muzzle to be thinner than the breech, so that when the piece is discharged, the heat from the explosion of the charge will expand the muzzle instantaneously on account of its thinness, and cause it to close the joint between the metallic cartridge tube and the chamber of the gun barrel into which it is inserted, and thus prevent any part of the explosion escaping at the breech, except that which issues from the vent, and also preventing the same degree of recoil as in the use of the cylindrical metallic cartridge chamber, the points of friction being in annular circles from the muzzle of the tube to the breech against the interior surface of the chamber of the gun into which the cartridge is inserted, which chamber is made of corresponding shape and size to that of the external surface of the cartridge tube. Also in making the bore of the metallic cartridge tube, next the breech, the shape of a parabola. Likewise in giving the vent an angular direction, from the nipple to the centre of the parabolic end of the chamber for the charge. Also in the employment of a hinged holder, for holding the metallic cartridge tube firmly in the chamber of the gun barrel, with the muzzle close against the shoulder formed in the chamber of the barrel, and preventing any recoil of the cartridge tube at the discharge of the piece; the hinges by which it is connected to the barrel allowing of its easy and ready insertion and removal during the operation of changing the tube in firing the gun in quick succession, being in the most convenient position on the gun, and always in operation.

Claim.—The hinged holder and cap, in combination with the frustum of a cone metallic cartridge tube.

For an Improvement in Indicating Telegraphs. *L. G. Curtis.*

Claims.—1st. A mode of conveying intelligence at distances, by means of a revolving toothed dial-plate marked with the several successive repetitions of the several numerals, 0, 1, 2, 3, 4, arranged in a circle on the face of the same, for representing the letters of the alphabet, said dial-plate being turned by degrees, as required, by the combination of escapement, cord, and weight, the pallets, lever, and spring, the armature and lever being actuated by the electro-magnet, by breaking and forming the circuit.

2nd. A peculiar construction of the escapement for actuating the dial-plate, consisting of the combination of the pallet bar, the pallets, and the triangular teeth; the whole work being confined to the inside, instead of being on the periphery of the wheels, as pallets and teeth of escapements heretofore have been constructed.

3rd. A system of signs, consisting of the combination of the numerals 0, 1, 2, 3, 4, for indicating all the letters of the alphabet, and words and sentences, by the use of which the necessity of having the whole or any part of the alphabet on the revolving disc, and of turning it a revolution, or nearly so, in order to indicate a particular letter, is dispensed with, it being only necessary to turn the dial-plate a segment or so of a circle at each combination of figures to indicate a letter, which is done instantly by simply forming and breaking the circuit; and

having thus formed the letters, it is evident that words can be spelt with great rapidity.

FOR AN IMPROVEMENT IN CAMPHINE LAMPS. *Edwin B. Horn.*

The patentee says,—The object of my improvement is to procure for the lamp two very important advantages, viz., that of a reduction of shadow peculiar to astral and other lamps wherein the burner is made to extend through or into the fountain; also that of keeping or maintaining the camphine or volatile oil in the fountain at, or about at, its ordinary atmospheric temperature, in order that all or nearly all that portion of it which, in camphine lamps wherein the fountain is made of glass, and the burner is made to extend into or through it, and in direct contact with and through the fluid in it, is, by heat, transmitted through the burner, usually evaporated through the top of the fountain and wasted, may be saved, and burned with the remainder.

Claim.—A manner of constructing the fountain, in order to allow the rays of light proceeding from the wick of the burner to pass downwards through both the internal and external concentric sides or shells of the fountain: that is to say, an internal translucent side or shell, in combination with an external concentric translucent side or shell, whether the said two concentric translucent sides of the said fountain be connected together by a translucent or opaque bottom.

FOR AN IMPROVEMENT IN THE MANUFACTURE OF HUBS AND AXLES. *Stephen R. Hunter.*

"The first part of this invention relates to the construction of carriage wheels of wrought iron, and steel, and cast iron, and consists in making the inside and outside of the hub of sheet iron or steel, with a sheet metal washer at each end, and the spokes, which are made of thin steel or other metal, riveted or otherwise secured to the rim of the wheel, and let into the outer case of the hub, and formed with a mortise or indentation, where this is combined with the method of firmly securing the whole, by running cast-iron into, and filling up the space within the hub. And the second part of the invention relates to the construction of the axles of carriages, and consists in making the arm of the axle of sheet iron, bent to the required form, and secured in a steel or wrought iron axle by running cast iron into the space between."

Claims.—1. The method of making the hubs of carriage wheels, by forming the inner box and outer case or surface of sheet metal, and uniting them by filling the inner with cast iron, by running the molten iron in between them, as described; and, in combination with this method of forming the hub, the method of securing the spokes, by inserting their inner ends in the outer case of the hub, that the cast iron within the hub may run around and secure them in place, as described.

2. The method of forming the axles of carriages, by making the outer form of the arm of the axle of sheet iron, when this is united to the steel or wrought iron axle within by means of iron cast in the space between the two.

THE CELLULAR HOT-PLATE SYSTEM.—DAKIN *v.* BROWN AND CO.

An action for damages, arising out of the memorable explosion by which Mr. Dakin, of No. 1, St. Paul's Churchyard, lost his life (see *Mech. Mag.*, vol. xlviii., p. 470), came on for trial last week in the Court of Common Pleas. It was brought, under Lord Campbell's Act, by Mrs. Dakin, the widow and administratrix of the deceased, and on the ground that the accident had been caused by the faulty construction of the heating apparatus, which exploded, and which, our readers may remember, is constructed on the cellular plate system, of the patent for which the Defendants are proprietors. After the case had been opened, and one or two witnesses called for the Plaintiff, the case was stopped by the Defendants consenting to a verdict against them for 800*l.*, with full costs.

It is but fair to the inventor of the plates referred to (Mr. W. H. James), to state that nothing occurred in the course of the proceedings to throw any discredit on the invention itself, and that had the case been gone through with, it would have turned entirely on the sufficiency and soundness of the metal employed by the Defendants in the apparatus which exploded. The cellular plates have been, and are now, used with perfect success in too many instances to make it a matter of any doubt, that they only require to be made of good materials and properly put together to bear safely any degree of heat to which they need to be subjected. At the bakeries of the Limerick and Nenagh gaols, at the Model Kitchen, Dublin, and at the Biscuit Factory, Reading, heating apparatuses on this plan have been in use for nearly three years, and, as is testified by certificates which we have seen, have in all these cases given the utmost satisfaction :—"You may truly say," observes Messrs. Huntley and Palmer, of Reading, that "with us the principle of your oven has had a severe test, and we have no hesitation in saying that you now may, with the greatest certainty, undertake to put them up for any one and for any purpose."

In consequence of the Christmas holidays, no designs have been registered, and no English patents sealed this week, up to the time of going to press.

LIST OF IRISH PATENTS FROM THE 21ST OF NOVEMBER, TO THE 21ST OF DECEMBER, 1849.

Henry Knight, of Birmingham, for certain improvements in apparatus for printing, embossing, pressing and perforating. November 21.

Pierre Armand Lecomte Fontainemoreau, of No. 4, South-street, Finsbury, for certain improvements in weaving. (Communication.) Nov. 22.

Alfred Barlow, of Friday-street, London, warehouseman, for certain improvements in weaving. November 14.

Sir John Macneill, knight, of Dublin, and Thomas Barry, of Lyons, near Dublin, mechanic, for improvements in locomotive engines, and in the construction of railways. November 24.

John Combe, of Leeds, civil engineer, for improvements in machinery, for heckling, carding, winding, dressing, and weaving flax, cotton, silk, and other fibrous substances. November 24.

Conrad William Finzel, of the city and county of Bristol, sugar-refiner, for improvements in processes and machinery employed in and applicable to the manufacture of sugar. December 4.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for certain improvements in the manufacture of sugar. December 4.

William Buckwell, of the Artificial Granite Works, Battersea, Surrey, civil engineer, for improvements in compressing and solidifying fuel. December 11.

Robert Oxland, Plymouth, chemist, and John Oxland, of the same place, chemist, for improvements in the manufacture of sugar. December 15.

Robert Urwin, of Ashford, Kent, engineer, for certain improvements in steam engines, which may in whole or in part, be applicable to pumps and other machines not worked by steam power. December 15.

LIST OF SCOTCH PATENTS FROM THE 22ND OF NOVEMBER, TO THE 22ND OF DECEMBER, 1849.

John Jordon, of Liverpool, Lancaster, engineer, for certain improvements in the construction of ships and other vessels navigating on water. Sealed, November 26; four months.

William Garnett Taylor, of Burton Hall, Westmoreland, gentleman, for improvements in lint, and in linting machines, which improvements in linting machines are, in whole or in part, applicable to other purposes. November 29; six months.

William Edward Newton, of 66, Chancery-lane, Middlesex, civil engineer, for improvements in stoves, grates, and fireplaces, and in warming or heating buildings. (Communication.) November 30: six months.

George Buchanan, Edinburgh, civil engineer, for improvements in corks, valves, or stoppers, and in the use of flexible substances, for regulating or stopping the passage of fluids, and also in making joints of tubes and pipes, or other vessels. November 30; six months.

Charles Morey, citizen of the United States of America and now residing at Manchester, gentleman, for certain improvements in machinery or apparatus for sewing, embroidering, and uniting or ornamenting by stitches, various descriptions of textile fabrics. December 3; four months.

Thomas Worsdell, of Birmingham, manufacturer, for certain improvements in the manufacture of envelopes and cases, and in the tools and machinery used therein, part of which may be applied to other purposes. December 7; six months.

John Macintosh, of Berner-street, Middlesex, for improvements in furnaces, and machinery for obtaining power, and in regulating, measuring, and registering the flow of fluids and liquids. December 10; six months.

Peter Fairbairn, of Leeds, York, machinist, and John Hetherington, of Manchester, Lancaster, machinist, for certain improvements in machinery for preparing and spinning cotton, flax, and other fibrous substances. (Communication.) December 11; six months.

James Smith, of Deanston, Perth, but now residing in Glasgow, for certain improvements in treating the fleeces of sheep when on the animals. December 20; six months.

Edward Lyon Berthon, of Fareham, Southampton, clerk, M.A., for certain instruments for ascertaining and indicating the course or way, velocity, time, and draught of ships, and the rates of currents; also, for discharging water from ships, and for taking altitudes and levels at sea or land. December 20; four months.

ALPHABETICAL LIST OF NEW PATENTS GRANTED FOR ENGLAND, SCOTLAND, AND IRELAND.

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Ador	Light	24 Nov.	....	....	526
Ackroyd	Dressing and cleaning	19 Dec.	....	....	598
Aingworth	Metals	1 August.	....	....	119
Aitken	Weaving	....	27 Sept.	....	406
Amos and Clark	Paper	10 Nov.	21 Nov.	....	455,527
Attwood and Renton	Starch	13 Sep.	....	....	263
Attwood	Iron	5 Oct.	....	....	358
Bailey	Wearing apparel	4 July	....	....	23
Banister	Boiler tubes	12 Oct.	....	....	358
Barlow	Railways	....	14 Nov.	....	527
Barlow	Weaving	2 Nov.	19 Nov.	14 Nov.	455,527 622
Barlow	Pigment	29 Nov.	....	....	526
Barrow	Axle and axle boxes	24 Nov.	....	....	526
Bashfield	Manure	27 Sept.	....	....	310
Baxter	Coloured engravings	30 August.	....	....	214
Barker	Sawing and cutting	10 Nov.	....	....	455
Berthon	Marine velocimeter	19 Dec.	20 Dec.	....	598,622
Bertrand	Preventing carriage accidents	30 August	....	....	214
Bessemer	Fuel and furnaces	20 Sept.	....	....	287
Bethell	Preserving substances	....	....	1 June	23
Birkmyre	Sugar	12 Dec.	....	....	575
Blake	Lamps	16 August	....	....	166
Bochner	Letter press printing	16 August	....	....	166
Boggett	Heating and evaporating	27 Sept.	14 Sep.	....	310,311
Bonell	Rotary engines, carriages and vessels	12 Oct.	....	....	358
Boucher	Cards	1 August	....	....	118
Bowden and Longmaid	Soap	4 July	....	....	22
Brandt	Bearings	....	11 Oct.	....	406
Brindley	Papier maché	17 Nov.	....	....	479
Brooman	Steam generators	4 July	....	....	22
Brooman	Extracting, depurating, forming, drying and evaporating	16 August	....	....	165
Brooman	Saddles and harness	13 Sept.	....	....	263
Brotherhood	Covers for wagons	18 July	....	....	455
Brown	Rolling mills	4 July	....	....	23
Brown	Fumigating plants	13 Sept	....	....	263
Brown, Mapple and Williams	Electric telegraphs and clocks	18 July	....	....	70
Browne	Looms	....	15 Oct.	22 Oct.	406,527
Browne	Stoves	4 July	....	....	23
Browne & Veale	Pulverising Stones	27 Sept.	....	....	310
Buchanan	Cocks, valves and joints	3 Dec.	30 Nov.	....	551,622

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Hackworth	Steam engines	15 Dec.	....	....	598
Haig..........	Motive power	6 Sept.	18 Sept.	....	238,311
Haines	Bands, hose, and buffers..	2 Nov.	....	....	455
Hamilton......	Cutting wood	....	....	28 June	143
Hancock	Hosiery goods	17 Nov.	....	....	502
Handley, Duncan and McGlasham	Railway breaks	20 Sept.	....	....	287
Harcourt	Vices, hinges and metal ..	1 August	....	....	118
Harcourt	Knobs and handles......	15 Dec.	....	....	598
Harrington	Teeth	1 August	....	....	118
Haywood	Weaving	13 Sept.	11 Sept.	....	263,310
Heath	Steel	6 Sept.	....	....	238
Henson	Railways and carriages ..	18 July	....	....	455
Higgins and Whitworth	Preparing fibrous materials	24 Sept.	....	....	336
Hills	Peat and gas	24 Nov.	....	....	526
Hobson	Horse-shoes	15 Dec.	....	....	596
Holdsworth ..	Marine boilers and funnels	9 August	....	....	143
Holland	Steel..................	18 July	11 Sept.	6 Oct.	70,310 406
Holt........	Preparing fibrous substances and weighing machines	24 July	5 Nov.	....	94,526
Holt..........	Musical instruments	10 Dec.	....	....	575
Hosking	Pavement..............	6 Sept.	....	....	238
How..........	Salinometer	18 July	1 August	....	70,214
Hulett & Paddon	Gas meters and regulators.	18 Oct.	....	....	283
Jamieson	Looms	4 Oct.	....	....	336
Jenkinson and Priestley ..	Fibrous substances	12 Dec.	....	....	575
Johnson and Cliffe	Furnaces	12 Oct,	....	....	358
Jordan........	Ships	2 Nov.	26 Nov.	....	454,622
Heely and Wilkinson	Looped fabrics..........	10 Nov.	....	....	455
Kenworthy	Power looms	....	16 July	....	94
Kirkman	Spinning and twisting ..	18 Oct.	....	....	383
Knab	Distilling..............	1 August	....	....	119
Knight......	Printing, embossing, pressing, and perforating	....	12 Nov.	21 Nov.	527,632
Knowles	Iron and steel	4 July	....	....	22
Knowlys	Mineral and vegetable substances, and generation and application of heat............	9 August	5 Nov.	....	143,527
Knowlys	Application, removal and compression of atmospheric air	....	....	10 Sept.	311
Lamplough ..	Supplying pure water to cities	24 Nov.	....	....	526
Larkin and Rhodes....	Preparing, spinning, doubling, and weaving.	12 Oct.	....	....	358

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Newton	Steam boilers	23 August	17 Sept.	6 Nov.	190,311 527
Newton	Sugar	23 August	....	....	190
Newton	Pumps	20 Sept.	....	....	287
Newton	Knobs	27 Sept.	....	....	310
Newton	Planing, tongueing, and grooving boards	5 Oct.	24 Oct.	....	358,526
Newton	Pipes	5 Oct.	....	....	358
Newton	Dressing, shaping, cutting, drilling, boring and driving piles	2 Nov.	....	....	455
Newton	Leather	17 Nov.	....	....	479
Newton	Stoves	....	30 Nov.	....	622
Newton	Fabrics	....	22 Oct.	....	406
Oldknow	Lace	15 Dec.	....	....	598
Oliver	Dyeing	10 Nov.	....	....	455
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